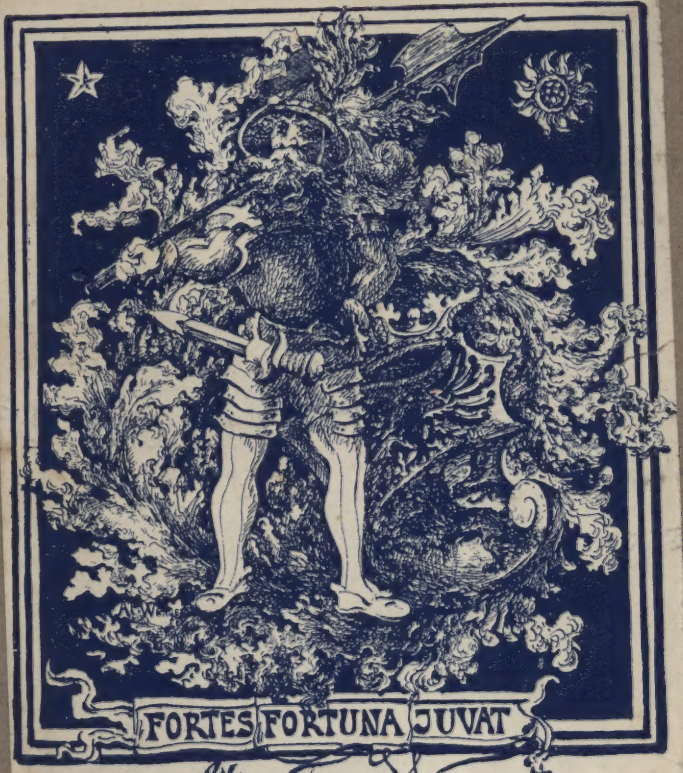

Walter J. Cooper

Princeton in 1846

1854

ART AND HISTORY

OF THE

POTTING BUSINESS,

COMPILED

FROM THE MOST PRACTICAL SOURCES,

FOR THE

ESPECIAL USE OF WORKING POTTERS,

BY

THEIR DEVOTED FRIEND,

WILLIAM EVANS.

SHELTON:

PRINTED AT THE EXAMINER OFFICE, MILES' BANK.

PREFACE.

TIME was, when most of the Handicrafts of this country were secrets, confined to the possession of those, whom Fortune, or Capital had placed in the position of EMPLOYERS. Few, amongst the working, or operative class, who could boast of a knowledge of the ingredients or processes, by which the most beautiful articles of British Manufacture have been wrought into existence. Indeed, it has been a matter of legal prosecution for any apprentice, or adult mechanic, having discovered some of the *secrets* of his profession, to divulge the same, in opposition to the expressed wish or sanction of his employer. This state of mental darkness is fast passing away; and the secrets of Operative Industry are becoming as generally known, as a Cheap Press and more liberal institutions can possibly make them. Working men no longer remain the mere physical manipulators of the craftily compounded materials of hidden processes and hoarded up recipes. They feel, that they have the same powers of ratiocination as the most wealthy of their employers; and that they have *a right* to know the component parts of all that pass through their hands. To this end, the present little volume is laid before the public; but more especially before *working* potters. As the name implies, it is the Art and History of the Potting Business; and is extracted from that most valuable, but expensive, work—the Popular Cyclopædia.

To enter into a detailed statement of the value of this little essay to operative potters, would be out of place here. The fact of its utility is self-evident. Where skilled labour is required in the manufacture

of any article, knowledge is absolutely requisite to direct that skill. And of all branches of British manufacture, Potting is the one that requires the most extensive knowledge of physical science, and a highly cultivated *taste* in what has been termed, the "Fine Arts." Chemistry, Minerology, or even Geology, come within its province. Optics, too, although barely dreamed of by *practical* potters, offers a wide field for enquiry. Light, with the *refractive* and *dispersive* powers of bodies, should not be neglected by those, who wish to further the advancement of Potting Manufacture. Colour and its *physical causes* are explained by optics. The refraction and polarisation of light offer an unexplored field for the most extensive enquiry. Sir David Brewster, by his experiments on the polarisation of light, has come to very important discoveries, as to the chemical composition of bodies. The Diamond, which, at one time, was considered to contain little or no hydrogen, has been found, from its refractive power of light, to contain the most of that gas, with the exception of the oil of cassia. All kinds of spars may be *chemically* analised by the polarisation of light; and if, as is now believed, the advancement of the Art of Potting, as far as *body* is concerned, mainly depends on the proper use of Felspar, may not the science of Optics materially assist in the discovery of that use? For my own part, I sincerely think, that it may; and not only assist as to the proper use of Felspar in the body of the ware, but also in every after embellishment. How worthy of consideration is the following extract, on the *production of colour by grooved surfaces*, taken from Brewster's Treatise on Optics, in the Cabinet Cyclopædia, especially to Messrs. Minton and Hollins, now engaged, under the protection of a patent, in the manufacture of that most beautiful personal ornament, the porcelain button!

"The principle of the production of colour by grooved surfaces, and of the communicability of those colours by pressure to various substances, has been happily applied to the arts by John Barton, Esq. By means of a deli-

cate engine, operating by a screw of the most accurate workmanship, he has succeeded in cutting grooves upon steel at the distance of from the 2000th to the 10,000th of an inch. These lines are cut with the point of a diamond; and such is their perfect parallelism and the uniformity of their distance, that while in mother-of-pearl we see only one prismatic image on each side of the common image of the candle, in the grooved steel surfaces prismatic images are seen, consisting of spectra, as perfect as those produced by the finest prisms. Nothing in nature or in art can surpass this brilliant display of colours; and Mr. Barton conceived the idea of forming buttons for gentlemen's dress, and articles of female ornament covered with grooves, beautifully arranged in patterns, and shining in the light of candles or lamps with all the hues of the prism. To these he gave the appropriate name of *Iris* ornaments. In forming the buttons, the patterns were drawn on steel dies, and these, when duly hardened, were used to stamp their impressions upon polished buttons of brass. In day-light the colours on these buttons are not easily distinguished, unless when the surface reflects the margin of a dark object seen against a light one; but in the light of the sun, and that of gas-flame or candles, these colours are scarcely if at all surpassed by the brilliant flashes of the diamond.

"The grooves thus made upon steel are, of course, all transferable to wax, isinglass, tin, lead, and other substances; and by indurating thin transparent films of isinglass between two of these grooved surfaces, covered with lines lying in all directions, we obtain a plate which produces by transmission the most extraordinary display of prismatic spectra that has ever been exhibited."

From the foregoing extract it will be seen, that the most beautiful phenomena might be produced by the reflection of light alone, from surfaces of peculiar form. Rainbow teints, imitations of mother-of-pearl, "the brilliant flashes of the diamond" are thus called into existence; and the causes of such phenomena clearly and scientifically explained.

To attempt, in the circumscribed limits of the introduction to a small work, anything like a lengthy exposition of the advantages to be derived from the study of any branch of physical science, would be profitless. All that can be done in so contracted a sphere, is to call the attention of the student, or the practical man, to sources of information, or objects of study, which might, perhaps, in the bustle of business, or from the more potent desire to follow beaten tracts, have escaped enquiry. To this end, the few observations here made on the science of Optics, and its possible applicability to the Art of Potting, have been endited. If but the attention of one practical mind, stored with the researches of common chemical investigation, be led into the more novel field of optical enquiry, the object of the writer is secured. Art—high art, is not to be obtained by the confinement of the mind to one branch of science alone. There is an identity of truth, or principle, throughout all physical existence! The links, that make up the circle of one branch of knowledge, have their connection with all other branches; and he, who would confine his observations to one course of study alone, is not unlike the squirrel in a cage,—for ever travelling, but making no progress.

I am fully aware, that the question with potting manufacturers, is not so much the *advancement* of the art, as the *discovery* of *cheaper processes* and *cheaper materials*, by which the present quality of manufacture can be wrought. To this end the enquiry of nearly all practical potters is now directed. The flow, for blue, although of recent introduction, has undergone several changes. That, now in use by W. Ridgway, Esq., is considered to be the best. Instead of washing, or placing the flow in the saggers, it is introduced in the glaze; and a great saving of expense is thereby secured.

The Flows, inserted in the appendix to this work, have been sold, and re-sold at an exhorbitant price, when first introduced in potting manufacture. Those recipes were sold, on two successive occasions, for £100

each time, and are now prized by the Messrs. Boyle, Dimmock, and Meigh, as the best in use.

In the *manufacture* of blue, likewise, much economy has, of late, been displayed. The process now in active operation, at Birmingham, has greatly cheapened the use of Cobalt. It is also thought, that a still further reduction will speedily take place. Field, in one of his recent works entitled "Chromatics," directs the attention of colour-makers to what he terms "*blue* ochre;"—a mineral, like most other ochres, to be met with in the west of England. For durability of teint, in oil painting especially, he states it to be second not even to Ultra-marine, or the blue of the Lapis Lazuli. It is in little use, and consequently in little demand; but might prove of the greatest importance to the practical potter.

One of the most bold attempts to cheapen the process of potting manufacture, was made, some two years ago, and is even now in course of perfecting by Mr. George Wall, of Manchester. A machine for the manufacture of *flat-ware*, has been invented, and nearly brought to perfection by that gentleman. Charles James Mason, Esq., of Fenton, was the first to introduce it in the Staffordshire Potteries, but the spirited opposition of the operatives, together with some defects in the machine itself, caused Mr. Mason to abandon it, after some few weeks' trial.

This machine is so constructed, as to be made to work either by steam, or hand power. In its first and most rude form, it was capable of producing, by the power of one man and a boy, as much ware, as is now produced by six adult operatives. But there was one great defect in nearly all the ware thus manufactured. Independent of the want of polishing, hair-cracks almost invariably made their appearance in the backs of the ware, after firing. This defect has not, as yet, been overcome; and it is a question of much doubt, whether it ever will be overcome. Some of the most practical men of the trade believe, that no mechanical appliace can ever remedy the evil, here alluded to. The ductility of clay requires something more than a fixed im-

moveable tool to fashion the ware. Human touch and skill are required to avoid the suppression, or the compression of air, which doubtless produces the hair-cracks in Wall's machine-made ware;—a defect, which nothing but volition and skilled manipulation can remedy.

In addition to Wall's machine, there is another now in use in some of the manufactories, in the north of England. Of the working of this, I have no personal knowledge, and, therefore, cannot advance an opinion. It is principally used in the manufacture of cups and bowls; and, I believe, although of a ruder construction than that of Wall's invention, is nevertheless of a more successful character.

But success in the cheapening of the process, by which earthenware is manufactured, cannot, in my humble opinion, advance, in the slightest degree, the interest of the manufacturer; and it is most evident, that it must detract from the interest of the operative. Mechanical appliances in the cotton and woollen business, have, it is well known, brought immense fortunes to many of the capitalists, engaged in those trades; but there is a wide difference between the domestic and social utility of pots, and the domestic and social utility of cotton and woollen goods. In the former, the cheapening of the selling price of the article cannot produce an increased demand, as the price of earthenware is now so low, and its utility of such an *unnecessary* character, that all, whose wants require plates, cups, saucers, &c., may purchase those, and other articles of potting, for the most trifling sums. On the other hand, the manufactures of cotton and woollen are absolutely *necessary;* and, previous to the introduction of machinery, they were sold at, comparatively speaking, an exhorbitant price. The cheapening of the selling prices of those articles would, from their social utility, governed *by fashion*, and from their individual and domestic utility, caused by imperative human wants, rapidly increase their consumption, and thus permit the accumulation of wealth in the manner and degree, so fully ap-

parent amongst the cotton lords of this country. This accumulation of wealth can never take place by the introduction of machinery, in the manufacture of china and earthenware. Mechanical appliances may increase, perhaps to an enormous extent, the *production* of potting goods, but they would not increase the *consumption;* the result of which would be, increased competition amongst the employers, to the injury of all, and a sorrowful depression in the social and domestic condition of the employed. Let it be hoped, that such a calamity will never be sought by potting manufacturers on the one hand; and, at the same time, never tolerated by the operatives, on the other.

Many have been the differences which have taken place between the employers and the operatives of the potting business, but in these, I may safely aver, that I have never sought, in any ungenerous manner, to foment such differences. On the contrary, throughout the period, in which I have had the honour to assist the potters' society to obtain a fair price for their labour, I have never, in a solitary instance, sought to stop the works of a single manufacturer by the injurious policy of a common *strike*, and without first trying every peaceable means to amicably adjust all difference, and to make friends of those, whom every-day intercourse should teach the utility of making their common path through life one of reciprocal friendship, confidence, and esteem.

The disastrous turnout of 1836-7 should stand as a warning to all future combinations of working potters. That turnout extended over a period of no less than twenty weeks; and every possible suffering was endured by the determined operatives, before they would bend to the more potent power of their combined employers. Ruin descended on the homes of many working potters. The savings of years were scattered in the space of twenty weeks; and no after exertion could replace the little hoarded means, thus irreparably lost. Indeed, to such an extent did the devotedness of the operatives extend, that every available property—every household

god!—the sale of which would bring *cash* to prolong the strike, was brought to common centres, and immediately disposed of, for the general good of the cause.

In addition to the means thus raised, thousands of pounds, sterling, were obtained from other trades, in the form of gifts and loans, the latter of which, to a great extent, have remained unpaid to this day. The trades of Sheffield, generously loaned £2,000; the trades of London £700, with a gift of £800; and other trades in a similar manner, but in smaller sums. It is calculated, that that turnout could not have cost less than Fifty Thousand Pounds! Alas! what a frightful sacrifice of money! and to what untold disgrace has it doomed the fair fame of working potters!

Out of the thousands of pounds borrowed, and which were loaned on the faith of the trade, and pledges given for a speedy re-payment, only a few paltry hundreds have, as yet, been returned. Sheffield, with all her generosity, is almost forgotten; and blackened, indeed, has become the trades' character of operative potters.

This incubus of a debt has paralized, to some extent, the late efforts of the trade. It is a drag which no success in trade's operations can leave behind;—it is an obstacle, which no sophistry can remove;—it is a blot, of so foul, black, and durable a character, that Time itself will not, cannot, dare not obliterate. Oh! how heartily do I wish, for the character of my trade, that it never had a being.

With these obstacles in their path, the present society of working potters commenced their proceedings, in 1843. They have never exceeded in numbers, two thousand members. In the first year of their existence, they established a trade's periodical,—the "Potters' Examiner and Workman's Advocate,"—which has progressed up to the present time; and which is now in full and mature existence; they destroyed the "Allowance System,"—a system, practised by manufacturers; and which exacted from the weekly wages of toiling potters, twopence, threepence, and, in some cases, *fourpince* in the shilling; and they paid to the Sheffield

trades £140 of debt-money, without receiving one farthing of assistance from the uncombined portion of their trade, amounting to five-sevenths of the whole of their body, or five thousand men. In the same year, they established an Emigration Society for the removal of Surplus Labour, enrolled the same under act of parliament, and are now in a fair way of bringing the principles of that society into practical operation. Officers are appointed, and the estate selected in the Wisconsin Territory of the United States of North America. That estate will be divided into twenty-acre farms; and immediate steps taken to people the same.

In the second and third years, the members secured for the *whole* of their trade, two successive raises in the price of their labour, amounting to, at least, seven-and-a-half per cent. on their weekly earnings. They have also now, in connection with their Emigration Society, a Printing Establishment, one of the best in the Staffordshire Potteries, at which they print their own trades' organ, and execute the principal business of the benefit societies of the neighbourhood. At that establishment the present little volume has been gotten up. It is an earnest of the cheap literature, which it is the intention of the proprietors, ever and anon, to issue for the instruction of their fellow-workmen. It may not be so complete, as the compiler might have desired to have made it, but the lowness of its price precluded the possibility of bestowing more labour upon its pages. *Profit* is not the object of its publication; nevertheless, a security against loss is indispensable; and that security has been obtained.

It will be seen, that, in addition to the work, advertised, there is an *appendix*, never published before; the value of which will be seen at a glance. The recipes, although thrown together in the most admirable confusion, will be found to contain a great amount of valuable information. That information must be gleaned by patient perusal, and by experiment. No student of the art can expect to become a *practical* potter by simply collecting recipes, and studying theories. Practical

knowledge must be obtained by *experiment*; and the *theoretical* information, here inserted, will supply a ground-work for the most perfect knowledge of, and proficiency in, the Art of Potting.

With these few observations, I beg to submit the present compilation to the perusal of my fellow-workmen in particular, and the public in general. If the little labour, I have here bestowed, may tend in the slightest degree, to forward the interest of my trade, or to advance a knowledge of the art, or in any way, to excite a spirit of enquiry and an emulation for still further improvement, the object of the work will be fully obtained.

For myself, I have no other motive than a sincere desire to advance the intelligence and skill of those, amongst whom my life has been cast; to add to their societarian, social, and political power; to assist them to remove, if possible, all difference, that may exist between them and their employers; to establish a just appreciation of the rights of labour, and a due respect for the interest and safety of capital;—in short to make the intercourse of man, social, political, and commercial, what God and nature intended that it should be,—a brotherly and independent exchange of human thought, human sympathy, and human service!

William Evans.

Shelton, August 3rd, 1846.

HISTORY.

China-Ware the finest and most beautiful of all the kinds of earthenware, and so called from China being the country which first supplied this material to the Dutch and English merchants. It is likewise called *Porcelain*, as some suppose, from the Portuguese *porcellana*, a cup or vessel; but Dr. Whittaker suggests, that the name may have arisen from the tint of the early specimens brought to Europe, resembling the flower of the *Purslain*, a light pink.

China-ware, when broken, presents a granular surface, with a texture compact, dense, firm, hard, vitreous, and durable; semi-transparent, with a covering of white glass, clear, smooth, unaffected by all acids, excepting the fluoric, and sustaining uninjured a sudden rise of temperature. In the properties of being semi-transparent and semi-vitrified, but in scarcely any of the preparatory processes and manipulations, is *china-ware* distinguished from good *earthenware*. Various articles for the use of the table and the toilet, are usually formed of china-ware, as also *chemical utensils*, retorts, alembics, crucibles, dishes, and many other articles indispensable in the laboratory.

Progress of the Manufacture.—The manufacture of porcelain by Europeans, did not commence till the beginning of the eighteenth century, although the knowledge of its value existed prior to the Christian era; for we find that Pompey's soldiers carried some from Pontus to Rome, B.C. 64. The existence of the manufacture of clay into vessels, in Britain, long prior to that date, is proved by the discovery of eathenware vessels, certainly

not choice specimens of workmanship or taste, but adapted for purposes of domestic utility; and, if we allow any weight to the circumstance of different excavations in several pottery towns in Staffordshire, indicating a long abstraction of their contents for purposes of the manufacture, and also regard the fact that one of those towns has a name which plainly determines the practice of the art—*Burslem-Bwlyeardslyme*, the *plot* of ground where is quarried the *clay* for *bowls;* and that the *Tygel-wyrthan*, the workers of tygs, drinking vessels or cups, (not the makers of *tiles*, of which very few then were needed) were residents in the district, their offspring being still called *Telwrights*—then we must admit that the manufacture was in operation in Staffordshire prior to the Saxons' gaining supreme power in the kingdom. In tracing the history of the practice of employing clay in the different kinds of ware, it is to be remarked that the early potters regarded merely the appearance of the baked *body*, or *clay material*, the proportions of the component, being directed by caprice. The early specimens appear to have been vitrified, to preclude porosity and brittleness; their formation indicates infancy in the manipulations, and a composition of not more than two materials, varied in quantities as their utility became more known. Many are to be seen in a museum at Burslem, where Mr. Wood has arranged them in accordance with dates, or eras of fifty years each. Previous to the 17th century, there existed little knowledge of the advantages resulting from *combination of clays;* but after that period, some specimens, distinguished for beautiful shape, tasteful ornament, and durability, with the names Thomas Toft, and Thomas Sans, and the date 1650, were made of a compound of brick clay, and the alumine or slate clay of the Burslem coal mines, and this compound was subsequently much employed in an improved ware called *scrolled* or *scrodled ware.*

The process of covering the ware with a glaze by means of the combustion of common salt, causing the fusion of the silica and iron in the clay, had long existed

on the continent; but it commenced in Staffordshire about 1680, in consequence of Mr. Thomas Palmer, of Bagnall, seeing an earthen vessel of his own manufacture, with the surface accidentally semi-vitrified, by the heat and salt of a boiler for pork pickle. The process, during many years, was practised on all coarse brown ware, and some other kinds, and is continued at Lambeth, Bristol, Church Gresley, and Chesterfield. The common brick clay, and excess of decomposed slate clay, with fine sand intermingled, by Mr. William Miles of Hanley, produced *white stoneware;* and dusting the pulverized ores of lead and manganese over the surface in the first state, formed the *brown stoneware.* The combustibility of the lead promoted the fusion of the silica on the surface, and some employed manganese and salt. In Burslem, a different kind of ware was made by mixing the marl, where the coal bussets, or crops out, with the finely pulverized millstone grit of the moorland ridge. This is the *crouch ware*, which, when glazed with salt, appears compact, clean, and durable; and, at this day, the thin pieces, by vitrescence rendered semi-transparent, excite surprise that they failed to suggest the manufacture of porcelain.

About 1690, the brothers Elers of Nuremberg, from the Chesterton brick clay, and the fine red clay of Bradwell and Brownhills, manufactured *red porcelain;* also a *black ware;* and it would seem, that this latter, now called *Egyptian*, was suggested by the appearance of some parts of the red ware, which contained excess of iron, being left of a dark colour when baked. We know not who first introduced the practice of mixing fine grit with Devonshire clay, and when a certain heat, by adding salt for the purpose of glazing the surface, transformed crouch ware into the best *stoneware*, having all the essential qualities of the finest Japanese porcelain. Mr. Astbury, of Shelton, by mimicking the idiot, obtained employment under Messrs. Elers, and made himself acquainted with their peculiar processes. He afterwards manufactured *white stoneware* from the Shelton marl and Devonshire clay; he also made *white dipped*

ware; and being required to visit London on business, a disease of his horse's eyes, at Dunstable, being cured by the powder of a calcined flint, he noticed its white appearance, adopted it among the materials used to wash his vessels; but, erelong, he mixed it with the Devonshire clay, to form the first *white pottery* or *chalk body*. His son, Thomas Astbury, by mixing the marl of Fenton Calvert, instead of the Shelton marl with Devonshire clay, formed the first *cream-coloured stone-ware*. During the period of Mr. Astbury's improvement of the earthenware, the apprentice of a druggist in Saxony, having obliged one of those self-deluded persons who sought for the *elixir vitæ*, was, in return, made acquainted with some of the processes employed for chemical purposes. The youth deserted his master, to pursue his chimeras, but was brought back, and incarcerated, but supplied with whatever he required; and here he transmuted rocks into a ware, more valuable to his country than would have been the phantasms he sought—*the powder of projection, and the philosopher's stone*,—and for which he was ennobled as the Baron de Botscher. This is the *Dresden china*. This invention caused a great sensation in France and Prussia; and Reaumur, by indefatigable researches into the nature of the oriental and Dresden chinas, supplied that information which raised the *Sevres china* to a degree of beauty and elegance, greatly surpassing all that had been previously manufactured.

The elegant shapes of the French china surprised the British manufacturers; and moulds in brass or very strong clay were made for the purpose of imitation. But the first knowledge of the subject in England was received through the medium of Ralph Daniel, of Cobridge, who left his home and went to Paris, where he was employed quickly as an expert thrower. Here he ascertained that all the moulds used in the French manufactories were of plaster of Paris, and his information caused the practice to be adopted by the English potters.

Mr. William Littler, about 1750, commenced making

a semi-transparent ware, which he called *china;* and, in accomplishing his purpose, he expended his patrimony, the Brownhills estate, Burslem. But his productions are every way very different from the china which, about the same date, was made at Derby by the ingenious Mr. Dewsbury, and which now continues in considerable demand. At Worcester, also, china of a very superior quality is manufactured, without other aid than the genius and enterprise of the proprietors. And, in more recent times, the china made at Coalport, Salop, has obtained much celebrity.

The combination of different clays with metallic oxides, iron, manganese, and lead, by Thomas Whieldon of Fenton, and others, produced *tortoise-shell ware*, and imitations of agate for knife-hafts, and snuff boxes; and here Josiah Wedgewood made his first essays at improving the manufacture. But, previously,

Thomas and John Wedgewood, of Burslem, carried forward the manufacture of white stoneware, salt-glazed, and formed into a great variety of ornamed utensils, to such an extent, as to realise a very large fortune for their descendents; and when they retired from business, they transferred it to the person who had married their niece, Josiah Wedgwood, who afterwards obtained so much celebrity for his improvements in the arts, and of whom an ample biographical notice will be given under the head, *Wedgewood, Josiah.* Mr. Aaron Wedgewood, father of Thomas and John Wedgewood, and Mr. W. Littler, adopted a mixture of fusible materials for glazing their ware, and which they applied by brushes to the surface, or by immersion, while the vessels were in the clay state; and this practice was becoming general, when, most opportunely, Mr. Enoch Booth of Tunstall, about 1750, who was then making ware of a combination of the native clays, carefully washed, and afterwards mixed with those from Devon and Dorset, and some ground flint, availing himself of Reaumur's glazes (see the old editions of the *Handmaid to the Art*), and completely changed the *modus operandi* of the manufacture. His ware was baked once, and, after being carefully

sorted, only all the perfect ware was then immersed carefully in the fluid mixture of the components, and when again baked received, from the tint, the appellation of *cream-colour*. This method is now general. Mrs. Warburton, of Hotlane, Burslem, improved the quality of the glaze, and Josiah Wedgewood improved the quality also of the ware, and thus formed what was the basis of his fortune—the very noted *queen's ware*.

Mr. J. Wedgewood first introduced into the components of one kind of earthenware, *jasper*, the sulphate of barytes, or cauk-stone, and this ware remains unrivalled in its fabric, particularly for chemical utensils. This is his only addition to the materials of the manufacture. His employment of the most intelligent workmen was consequent on his commencing the imitation in his jasper, of the medallions, cameos, &c. of the best artists.

There is much probability that inspection of the specimens in the museum of the Royal Society, of the petunt-se and ka-o-lin of the Chinese potters, which Dr. Sherard had supplied, suggested to Mr. Cookworthy of Plymouth, the examination of the *granen* of Cornwall. He first announced to English potters, that the felspar (melting spar, which, in the white granite of Cornwall, is combined with quartz and mica), supplies the most essential component of the oriental china; then obtained a patent for its use in the manufacture, which right he transferred to Mr. Champion of Bristol, who, failing in his attempts to manufacture china in that city, disposed of his interest in the patent, to some persons in Staffordshire, ever since known under the appellation of *The New Hall Company*.

We know not the name of the person who first introduced into the clay for china, a certain quantity of the *earth of bones* to aid the semi-transparency, and named *bone china;* and also, of him who first employed ground *granen*, (under the name of *composition*, supplied by the New Hall Company), in that of the best earthenware, from its whiteness called *chalky body*. The ornamenting of ware by blue painting was next added to pre-

vious improvements. Mr. Cookworthy had previously attempted a shining blue glaze; and, afterwards, he instructed Roger Kinnaston to prepare blue, from either zaffres or cobalt ore; and the business is now of great importance and value. This was accompanied by the process of using gold, which will bear the burnisher, first brought to perfection by Mr. Hancock, of Etruria (yet alive, 1834); and who, subsequently, invented the *lustre;* which was improved to imitate *silver*, by John Gardner, Stoke; and *gold*, by William Hennys, Burslem. And *black printing* was successfully practised by Sadler and Grier, Liverpool; W. Smith, and T. Radford, Hanley. John Turner, Lane End, produced *stone china;* and John Lucock (still alive) introduced *blue printing*, under glaze.

At Lane End, in 1795, Mr. Cheatham produced the *pearl* ware, named from being in white ware what the jasper is in coloured. In 1800, Mr. Turner, of the same town, produced the *patent stoneware;* afterwards imitated by Mason's *patent ironstone china.* Mr. Winter, of Tunstall, made a boast of producing the only *true porcelain* of the potteries (certainly a soft kind). Mr. Josiah Spode produced bone china of considerable excellence from 1800 till 1820, when he commenced an improvement entitled to special notice. Mr. Ryan, F.S.A., discovered, in a deserted lead mine, *felspar* in the two states which the Chinese call pe-tunt-se and ka-o-lin, or rock and clay. After an offer of the spar to Messrs. Rose, of Coalport, (who denounced it as useless, though they have used it since), Mr. Ryan got it tried by Mr. Spode, Stoke, and this person's satisfaction with the result was so great, that he purchased a supply which is still used in his manufactory. In the present state of matters there is every possibility of carrying the manufacture to a degree of excellence which will gratify the expectations of the most sanguine friends of science. The resources of the manufacturer have been greatly augmented by scientific research in recent times. The analysis of minerals by the chemist shews that the earth teems with treasures calculated for the advancement of

the art, and that her bounties will ever amply remunerate the labours of the patient inquirer. Of these, every one who aspires to the character of a scientific potter should avail himself, not knowing what fortunate combination of materials he may yet discover, or what improvement he may make in the art. It was by attention to the relative qualities of different substances that the early manufacturers succeeded in raising the art to its present state of excellence, and by a continuance of similar attention it may advance still nearer to perfection.

The following is a description of the materials and processes of the manufacture of china and earthenware, in the present improved state of

THE ART:—

Properties and Materials of different China and Earthenware.—The remark of Vauquelin, that "good pottery differs from inferior, much less in the number of its components, than in their being combined in proper proportions," applies with equal force to the *soft* and the *hard china wares*. Their basis is a mineral which bakes very white, and which, either alone, or when in combination with other components, from undergoing incipient vitrescence, becomes semi-transparent. The basis of earthenware is clay and flint in determined proportions. The recipes subsequently introduced, will exhibit an accurate view of the different components. As the hardness, infusibility, and unalterability require the presence of flint, so only will firmness and ready baking, as well as adequate plasticity for easy working, be obtained by the presence of clay; for excess of either is injurious.

The Japan china is considered superior to all other of oriental manufacture, in its close and compact granular texture, its sonorosity when struck with a hard body, its hardness like flint in giving sparks with steel, its infusibility by baking, its smooth and shining appearance, and its capability of being used to boil liquids, and

bearing higher temperature without any injury. Its components are, per cent., fifty pe-tunt-se, and fifty ka-o-lin. Only in very recent times has the fact been ascertained, that these were the *chief* components, but not the *only ingredients*.

The *pe-tunt-se* has its appellation from being an impalpable powder formed into square cakes. Fragments of a kind of rocky mineral, of which the greenish is the best, (now proved to be *felspar*, with a small portion of protosulphate of iron,) are forcibly agitated in vessels of water until the particles abraded render the fluid frothy; the foam is skimmed off, and put into another vessel; and this process is repeated with the mass till it ceases to supply froth. The skimmings are left to subside, and when the water is quite transparent, it is drawn off carefully, the powder is slowly dried, and then formed into cakes, in size and thickness much like floor-tiles. Reaumur found it fusible at a moderate heat, without addition, and readily vitrifiable.

The *ka-o-lin*, is so called, from being in a state by nature, almost ready for the manufacturer. It is found in beds. and is obviously felspar, reduced by atmosperic action into the state of clay. It is, by abrasion, similar to the pe-tunt-se, formed into foam, allowed to subside, and then cut into squares. In combination with the other, they promote the consolidation of the two. Reaumur was unable to fuse it by any heat he could employ.

The pe-tunt-se and ka-o-lin are next mixed with an equal proportion of aluminous earth; and this is indispensable, as well to render the *clay* plastic for the working, as to make it ductile and tenacious to bear the manipulations of turning and handling, or moulding. These are mixed well together, and then thrown into a large pit, in which they are, by treading, more intimately commixed; and from this pit, portions are taken when wanted, and rolled in various ways, to disperse all air bubbles, and render the clay homogeneous. Only when these processes have been properly conducted, will the clay afford a ware which will bear, without injury

by warping, cracking, or fusion, the further processes of ornamenting and baking.

The splendour and whiteness of china depend mainly on the *glaze;* which is stated to be formed of the whitest rock which supplies pe-tunt-se, treated similarly to the others. To 100 pounds' weight of this white powder, is added one pound of *the powder* of *che-kao*, a saline fritt, much like gypsum, or alum; also 100 pounds of lime and ashes, with another pound of the salt; these are formed into fluids having like specific gravity; and then ten of the former is mixed with one of the latter. With the Chinese potters, the preparation of the clay is constantly in operation; and usually remains in the pits from ten to twenty years prior to being used. The longer it has remained there, the more is its value; and instances are not unfrequent, of one potter manufacturing his ware from clay first prepared by his grandfather.

The *hoa-che* china, a very expensive kind, which has its name from its glutinous appearance, in addition to the pe-tunt-se, ka-o-lin, and alumine, has *steatites*, (soapstone, doubtless from its *saponaceous* quality,) washed from its impurities, oxide of iron, &c., then pulverized, abraded in water, and treated similarly to the others; and, in consequence of this component, although its grain is very fine, and its delicacy and beauty extreme, when among the component parts of the glaze,—presenting opportunity for superior decoration by ornament,—the ware is brittle, deficient in weight, and only by great attention properly baked.

The best *Persian china*, of Shiraz, is equal to that of Canton in every property, and superior in some particulars; it is, consequently, substituted for that frequently by the Dutch merchants, and requires some judgment to be distinguished as not Indian merchandise. That its material is *felspar* is obvious from its fracture presenting a fineness of grain, and a semi-transparency similar to the Chinese; and also, because it will bear to be used as moulds for casts, and as vessels in which fluids may be boiled, or minerals pulverized.

The *Dresden* or *Saxon china* has some qualities which render it decidedly superior to the oriental. Its fracture certainly does not exhibit a granular texture, but a compact, shining, uniform mass, resembling white enamel, proving that it is compounded of one kind of materials, which by fusion will cause its density, smoothness, and superior lustre; and another infusible, whence result its beautiful white appearance, firmness, and solidity. These, in combination, regularly contract together, and form china more firm and compact than those of China and Japan, yet equally hard to give sparks with steel, sonorous when struck with wood or the hand, and not fusible by any heat employed in baking.

At Naples and Florence, beautiful china is made, approaching in excellence that of Japan and Canton. While at Berlin, Frankendal, Vienna, and other places in Germany, china is made of the same materials as are used for the Dresden; but, by varying either, or both proportions, as well as processes, they differ from each other, and also from that of Dresden.

The invention of French china manufacture is due to Reaumur; and establishments are formed at Paris, Villeroy, and Orleans. That of Sevres has a grain neither so close nor so fine as that of Japan; but much like lump sugar; and excelling all the others of French fabrication in its white shining lustre, its fine glaze, elegance of shape, beautifully coloured grounds, and magnificent gildings. *Reaumur's porcelain* is manufactured of pulverized common glass and fluxes, or of vitrescent stones and saline fluxes.

The requisite minerals for the components of the best *hard* China, are sparingly supplied by nature, and, therefore, secures an additional value to the ware; while those which are employed in the several kinds of earthenware, are not uncommon in most countries. Silica and alumine, whether mechanically or naturally combined, do not vitrify together, although they are more readily and frequently combined than by any of the other earths: it is supposed, that, in these combinations,

silica exercises the properties of an acid, and alumine those of a neutralizer, though not strictly an alkali. Silica, when pure, is transparent, and, when calcined, loses much of its adhesive property; and, even in its pulverized state, communicates to the ware hardness, firmness, and unalteration by baking. Alumine is opaque, and retentive of water at extremely high heats, 4717° Fahrenheit, of which fuses silver. When silica and alumine are properly combined in water, their reciprocal tendencies cause strong adhesion, so that, when hardened merely by evaporation into a paste, they resist decomposition by the atmosphere; and, when they have been subjected to the heat requisite to dissipate the water of the mass, in which 46 per cent. of the weight is lost, there remains a body durable, firm, and unaffected by change of temperature. The silica requisite is obtained by using the *flints* from the Sussex coast, and near Antrim, Ireland. The best for the purpose have a blackish appearance. They are first calcined in a small kiln, in form similar to those large ones used for limestone; next they are broken in pieces while hot, and cast into water in the pan, in which, by mechanical power, they are abraded together, till the mass has the consistence of cream, with a density of 32 oz. per ale pint. When again dried at 4688° Fahrenheit, 27 per cent. is lost. The alumine is supplied from four kinds of clay,—two from Biddeford, and the other two from the Isle of Purbeck, that is, *pipe clay;* the fracture is earthy, to the feel they are greasy, adhering to the tongue; baking into a white substance, more tenacious and plastic, and, though not easily fused, more fusible than porcelain clay. The names of *blue*, *brown*, *black*, and *cracking*, are applied according to their properties. The *blue* has more force, with a certain quantity of flint, than any of the others; and, while contracting little, form together a white durable ware. The *brown* contracts rather more than the blue, yet supplies a very white ware when in biscuit; but the sulphuric acid it contains causes great attention to the compounds of the *lead* glaze, else *crazing* will ensue. The *black* has car-

bonaceous particles admixtured, which, by baking, lose their acid, and are not regarded as injurious. And the *cracking* produces a fine white ware; but, from its excess of alumine, so much contracts by baking, that it only can be safely used in combination with a certain proportion of blue clay. As very accurate experiments determine that a vessel formed of any of the native clays alone, will contract, from evaporation, till sufficiently dry for baking, at least one-tenth in dimension, there cannot be further reason desired, to prove that plus of alumine, which readily is bibulous, prevents a vessel being durable and firm. The *grauen*, or Cornish granate, a natural mixture of quartz, mica, and felspar, is used in large quantities. It is ground similarly to flint; and when dried on small kilns similarly to the plaster of Paris, is often called *composition*. The quartz prevents too great contraction of the ware during baking; and the felspar, having 16 per cent. of potass, renders the mixture more readily vitrescent by baking, and so promotes the compactness of the ware. The mica has 4 per cent. fluate of lime; and although this is but a very small quantity, its potency as a flux promotes vitrescence, and its acid intimately combines with the silica, until a rise of temperature, and the presence of water, produce a re-tendency to action. This is a latent cause of *crazing*. The *china clay* of Cornwall, first introduced by Mr. Cookworthy, is the extremely white and impalpable powder, by running water washed off the broken pieces of the blocks of decomposed white granite, collected in catch pools, from which it is at certain times taken, dried, and forwarded to the potters. The washing separates the quartz and mica, and also much of the potass, which causes the clay to be infusible. But all the clay in this state is not alike in quality: some has more potass in the felspar, and is moderately fusible at a white heat; while others remain refractory in any heat of the potter's oven. In 1834, Mr. Ryan introduced a native clay for china, which possesses all the essential qualities of the Japan ka-o-lin. Most of the English china contains the earthy residue of *bones*,

boiled, to extract all gelatinous ingredients, next calcined, and then ground similarly to flints. This component, by increasing the porosity, aids the semi-transparency, and supplies additional whiteness, by the phosphoric acid correcting any iron in the other components. This is the latent cause of china seldom bearing a sudden rise of temperature, or sudden change. *Magnesian clay*, in its indurated state, as soap rock or teatite, and also in its plastic form, from their decomposition, has been occasionally used to improve the whiteness of the body or ware. It has a cream colour, strong earthy odour, minutely foliated texture, slight greasy lustre, takes a polish from the nail, stains the fingers, is very friable, smooth, unctuous, and plastic to the touch, and, on the tongue, dissolves into a pulp free from any gritty particles. Only when adequate aid results from alkaline components, can this be used, because its pulverulent nature renders it deleterious in the clay. There are also used considerable quantities of *slate clay* and *shule clay*, used for different purposes hereafter explained. The colour of the slate clay is from ash grey to ochre yellow; it is foliated texture, is unctuous and smooth to the touch; scarcely gritty between the teeth. The kind found in thick strata is darker coloured and less plastic than that from thin strata. And that obtained from peat mosses is rather white ash coloured. The *shule clay* is varied from greyish blue to bluish black, with foliated texture, smooth unctuous feel, bears to be polished by the nail, small gritty particles, very tenacious and ductile: and, taken from the basseting of the coal strata, to be used for saggars, and other purposes. This *marl*, as it is called in the Potteries, is the upper casing, or *roofing*, of the coal strata; while another kind, called *clunch* clay, is the *flooring* of the strata. The *brick* and *tile* clay has a colour from yellow to dark red, blue, and green; and, while very plastic, adhering to the tongue, soft and greasy to the feel, and a fine earthy fracture, supplies a common material for coarse pottery, and as a component for black, brown, and lustre wares.

Composition of China and Earthenware.—Modern chemistry has thrown much light on this subject, not only in enabling us to analyze more perfectly the bodies which constitute these wares, but also in determining the exact proportions in which they combine; and we shall introduce a series of recipes, the result of the combined researches of the chemist and practical potter. The accuracy of these recipes, which are given in centesimal proportions, may be implicitly relied upon.

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Bone	40	50	40	37	20	45	42	64	40	46	28	25	35	29	37	34
China Clay	35	35	20	25	48	23	30	20	20	20	7	16	25	8	31	32
Cornish Stone	23	8	40	13	24	22	27	16	24	28	40	25	40	40	25	23
Flint	2	3	..	25	..	..	1	..	6	..	5	9	..	5	2	6
Blue Clay	..	4	..	..	8	10	..	..	10	6	20	25	..	18	5	5

To each 100 lbs. add 1 oz. of best cobalt blue, ground.

The above are only *mixed* together, to constitute the clay.

Other china bodies have much of their substance *fritted*. This process is adopted to chimically combine all the principal components together, by subjecting them, during some hours, to a gradually-raised temperature; and which, dissipating the aqueous, gaseous, carbonaceous, and other volatile ingredients, effects their complete fusion, and renders more readily obtainable all the properties of the several minerals in the compound. Wherefore, the fusible components must be in definite proportion to the others; and, unless this process was employed, there is a possibility of the high heats of the baking volatilizing the alkali before complete fusion ensues. The *fritt* is ground (similarly to flint) into impalpable powder, in which state it is mixed with the other components that do not require to be fritted, in such proportions that there may continue a state of tenacity to bear the manipulations of throwing, moulding, or pressing.

The four annexed recipes are in common use by the persons whose names are affixed to them:

(1) *Fritt.*—Cornish stone, fifty; bone ash, fifty: grind and mix for *body*,—fritt, seventy-five; dry flint, five; blue clay, twenty.—*J. Mare.*

(2) *Fritt.*—Cornish stone, forty; bone ash, forty; cullett, twenty: grind and mix for *body*,—fritt, eighty; blue clay, twenty. Bake very highly.—*J. Clowes.*

(3) *Fritt.*—Cornish stone, twenty-two; flint, twenty-eight; cullett, twenty eight; white lead, twelve; salt, three; borax, six; blue calx, one: grind and mix for *body*,—fritt, forty; china clay, forty-eight; blue clay, twelve.—*J. Pennington.*

(4) *Fritt.*—Cornish stone, forty; bone, twenty-nine; cullett, twenty-two; borax, nine: grind and mix for *body*,—fritt, forty-eight; china clay, thirty-eight; blue clay, fourteen.—*W. Marsh.*

The constitution of these bodies intimates a more dense and compact texture than the preceding; and the attempt itself is a most useful lesson in chemistry, when properly and steadily pursued.

The china now most esteemed for all the properties of the Japanese, and superior beauty of colour, has felspar among its components, in the proportions below:

Felspar.....	20	20	30	25	20	20	24	10	22
China Clay.....	20	25	30	25	30	25	26	20	30
Bone.....	60	45	40	50	35	55	50	60	48
Cornish Stone..	....	10	....	....	15	....	....	10	....

Stain with blue calx, as previously directed.

When such an extent of bone earth is present, as some of the recipes exhibit, there need not be any surprise that even very excellent felspar porcelain (to appearance,) frequently fails on sudden rise of temperature.

Some china of this kind, very superior in quality, is made by part of the components being prepared in fritt. *The two recipes annexed, exhibit the components and their proportions:*

(1) *Fritt.*—Felspar, (greenish,) seventy-five; borate of soda, twenty; muriate of ammonia, five. *Body*,—Fritt, fifty; china clay, fifty; or, fritt fifty; china clay, thirty; bone, twenty.

(2) *Fritt.*—Felspar (greenish), sixty; borax, twenty-five; nitre, five; sal-ammoniac, ten. *Body.*—Fritt, forty-five; china clay, forty; bone, fifteen; or, fritt, thirty-five; china clay, thirty; bone, thirty.

A particular kind, called stone china, *is compounded, (mostly for jugs and toilet services,) of the following components:*

No.	1	2	3	4	5	6	7	8
Cornish Stone.....	48	48	50	40	37	38	36	56
China Clay.....	27	30	33	30	28	30	32	30
Blue Clay	18	14	10	15	20	20	22	10
Flint	7	8	7	15	15	12	10	4

The *ironstone china* is formed by introducing ground *clay* from the smelting furnace, in the proportion of twenty-eight for seventy-two of No. 3 or 8, carefully blunging the fluids together.

Dry Bodies.—That class of wares which undergo incipient vitrescence, without any glaze on their surface. Of this species, the *red* and the *cottage brown* are compounded as below; the materials being well levigated, finely lawned, and carefully fired.

	Red.					*Brown.*				
No.	1	2	3	4	5	1	2	3	4	5
Bradwell Wood Clay...	25	25	40	25	40	60	80	50	48	60
Yellow Brick Clay.....	50	5	55	10	60	10	12	33	20	20
Blue or Black Clay....	..	50	..	40	..	22	..	..	16	10
Flint.....	25	20	5	25	..	8	4	..	..	..
Ochre or Manganese ..	..	..	..	..	..	..	4	17	16	10

Many flower pots and lustre jugs are formed of 3 and 4 red; and 4, 5, brown. Another kind of *red* is seen in the *porous body*, used for coolers of water, butter, and wine, and called *alcarazas* in Spain. These articles are baked in a very slow part of the oven; and, after being immersed in water till saturated, on any substance being

placed therein, the cold caused by evaporation reduces the temperature of that substance to a most palatable state. The components stated as forming those used in Spain, are sixty parts of compact marl, (Jamieson II. 194,) and thirty-six and a half of decomposed common hornblende. *But in Staffordshire, the following are the components:*

					Fawn.	
Indurated Marl (Filcher's) ...	88	84	84	86	88	86
Brown or Blue Clay	9	10	8	8	10	8
Flint	3	6	8	6	2	6

The marl must be well weathered, (several months exposed to the action of the atmosphere,) and the fluid mixture passed through a fourteen lawn; after which the other components are added. The articles are baked in the top of the oven when baking *glaze.*

The several shades of drab *are thus compounded:*

No.	1	2	3	4	5	6
Indurated Marl	23	22	43	44	45	26
Cornish Stone	45	40	45	45	42	....
China Clay	....	12	6	....	....	20
Blue Clay	23	24	6	10	8	40
Bone Earth or Flint	8	....	....	...	4	f.12
Manganese or Nickel	n 1	m 2	....	m 1	n 1	....

The *cane* (much similar to baked pastry) supplies many articles, from moulds likewise employed for jasper and pearl. *The components are:*

No.	1	2	3	4	5	6	7	8
Black Marl	88	44	56	60	64	64	60	76
Cornish Stone... ...	12	32	22	24	20	18	18	12
Brown or Blue Clay..	....	24	22	16	16	18	22	12

The *Egyptian, best black,* or *vitrified basalts,* is formed of these components:

No.	1	2	3	4	5	6	7	8
Blue Clay	46	53	50	37	40	40	48	44
China Clay	2	....	3	10	....	6	10	*stone* 4
Calcined Ochre	44	33	36	50	40	35	24	44
Manganese	18	2	3	3	5	5	6	8
Black Marl	....	12	8	....	15	14	12	....

The *pearl* is formed of these components, and is baked in the first ring of the biscuit oven, carefully raised and cooled :—

No.	1	2	3	4	5		6	7	8	9	10
Cornish Stone	60	52	54	54	60	With Fritt	50	46	60	66	54
China Clay	22	38	36	24	20		..	14	10	8	..
Blue Clay	14	5	4	16	12		38	24	18	15	30
							(1)	(2)	(3)	(3)	(4)
Ground Flint Glass	4	5	6	6	8		12	16	12	11	16

Or (1) *Fritt*—Flint Glass, 76 ; Red Lead, 22 ; Borax, 2.
— (2) *Fritt*— Do. 62 ; Do. 29 ; Do. 4 ; Nitre, 8 ; Flint 6.
— (3) *Fritt*— Do. 80 ; Do. 20 ;
— (4) *Fritt*— Do. 70 ; Do. 24 ; Do. 6.

The *jasper* is compounded either by *fritt*, or without it ; but the components require to be *ground* well together, before they are evaporated on the slip kiln.

No.	1	2	3	4	5	6	7		8	9	10	11
Cornish Stone	33	32	20	..	20	24	34		..	..		
Cauk Stone	27	45	28	35	36	30	20		32	..	30	34
China Clay	17	..	14	..	15	14	16	with Fritt	18	37	18	30
Blue Clay	17	18	18	35	20	22	23		18	13	20	6
Bone Earth	..	..	4	17	..	..	..					
									(1)	(2)	(3)	(4)
Flint or Glass	4	3	4 g 6	9	6	6	5		32	50	32	30
Blue Calx	2	2	6	4	3	4	2					

Or (1) *Fritt*—Cornish Stone, 40; Gypsum, 30; Flint Glass, 25; Blue Calx, 6.
— (2) *Fritt*—Cornish Stone, 50; Do. 50;
— (3) *Fritt*— Do. 35; Do. 26; Flint, 16; Bone, 15; Blue Calx, 8.
— (4) *Fritt*—Cornish Stone, 40; Do. 40; Flint, 6; Flint Glass, 12; Blue Calx, 2.

This is never glazed, because the heated suphuric acid of the cauk stone will decompose the glaze; even were it not formed of components in which the phosphoric, arsenic, or boracic acid, was present and ready to affect the acid of the barytes.

The *stonewares* of the best kind are thus compounded, and require to be baked in the first ring of the biscuit oven:—

No.	1	2	3	4	5	6	7
Cornish Stone	48	68	40	38	52	48	45
Blue Clay	25	28	30	20	24	24	21
China Clay	24	....	10	12	24	12	18
Flint	....	....	5	18	....	12	10
Ground Glass	3	4	15	11	....	4	6

The *chemical utensils'* body, so important to the students of analytical chemistry, has not received all the attention its utility demands. The charge is enormously high, compared with that for other wares; yet scarcely any is found to bear the raised temperature of a wind furnace. The components, (according to the recipes at present used,) are:—

No.	1	2	3	4	5
Cornish Stone	48	28	10	40	33
China Clay	24	....	20	20	20
Blue Clay	24	54	50	25	25
Indurated Marl	2	10	....	5	11
Flint	2	8	20	10	11

To counteract the effects of the different chemical preparations on the vessels, ground biscuit china is mixed in the proportion of forty to fifty per cent. with the preceding bodies; but, the addition of six per cent. sulphate of barytes, has recently been proved of the greatest utility.

Earthenware Bodies.—Some previous remarks intimate the want of scientific knowledge on this subject by manufacturers. To prove that they were not without a good foundation, the following recipes are given from a MS. very recently written by the superintendent of a large manufactory:—

1. Black clay, six barrowfuls; blue clay, four barrowfuls; cracking clay, two barrowfuls; when in slip, add six china clay, to one-fourth stone, ten flint.

2. Black clay, three barrowfuls; brown clay, two barrowfuls; blue clay, two barrowfuls; corn stone, forty pounds. In slip, to six, add one flint.

3. Blue clay, sixteen pailfuls, twenty-four ounce to pint; China clay, four pailfuls, twenty-four ounce to pint; flint, four pailfuls, thirty one ounce to pint.

4. Clay slip, fifty-four pints; china clay, eighteen pints; flint clay, sixteen pints.

In the manufacture of *delft ware*, a certain proportion of brick clay is mixed with the others, because the addition of oxide of iron among its components, by promoting the incipient vitrescence of the ware, more than compensates for the tint it communicates. Macquer gives these proportions: slate clay, fifty; blue clay, thirty; brick clay, twenty.

The appellation *delft ware*, is usually applied to the kind which manufacturers call *cream colour*, and, from royal patronage, was named *queen's ware.* Since its first introduction, however, it has undergone very great changes; and a particular method of ornamenting it, has caused the adaptation of the body to the ornament, in *blue printed ware.*

The components of *queen's ware*, or *cream colour*, are the following:—

No.	1	2	3	4	5	6	7	8	9	10
Blue Clay..	36	30	25	25	28	25	56	27	27	36
Black Clay	18	26	22	23	28	24	..	33	..	24
Brown Clay....	18	24	18	16	28	15	..	..	27	16
China Clay	..	..	16	16	..	15	20	70	..	..
Flint.....	28	20	16	16	16	16	20	33	44	24
Cornish Stone..	..	..	3	4	..	5	4	..	2	..

And, of the *blue printed* the following:—

No.	1	2	3	4	5	6	7	8	9	10	11
Blue Clay.....	30	30	30	30	30	28	13	32	30	30	25
Black Clay.....	20	30	10	..	18	6	..	16	12	10	15
Brown Clay....	15	..	..	12	..	..	20	..	12	10	10
Cracking Clay..	..	..	10	10	12	10	6	16	..	10	10
China Clay.....	15	15	26	20	20	20	27	16	20	20	24
Flint.....	20	25	24	23	20	22	30	20	20	20	16
Cornish Stone..	..	..	..	5	..	4	4	..	6	..	..

The *chalky body* ware has these components:—

No.	1	2	3	4	5	6	7	8	9	10
Blue Clay.....	24	24	29	27	29 Crk.	26 Brn.	.	55	36 Brn.	27 Brn.
China Clay.....	24	24	29	27	28	20 Blk.	..	14	20 Blk.	20 Blk.
Cambria Clay.....	...	..	..	..	....	24	60	17	20	14
Cornish Stone.....	2	..	..	2	..	....	..	3	....	....
Cambria Stone.....	..	..	..	..	....	...	20	..	....	....
Flint	50	52	42	44	36	26	20	11	24	30
Lime.....	..	..	...	..	7	4	..	..	....	....

Mr. Lakin's recipe is, blue clay, twenty-six; ground flint glass, twenty-six; flint, six; Lynn sand, twenty-six; bone earth, eight; composition, eight.

The *Lynn sand*, by its very fine grain, supersedes the expense of calcining and grinding flints; and yet some of the manufacturers calcine it previous to its employment. The *lime*, by promoting the vitrescence of the mass, renders the ware very compact, yet less refractory in high heats; and hence these chalky bodies were formerly in much request, because less liable to craze. This certainly might be expected, as it is well known that lime renders glass less liable to break from sudden rise of temperature. The *Cambria rock* and *clay*, have not yet been so extensively employed as their excellence might have led us to expect, and only because of the disregard of chemical science by the parties who first used them. When this auxiliary is allowed its proper share in the conducting of the processes, the Cambria clay will be found one of the most valuable components of British earthenware; yet obtainable at very moderate expense.

When proper attention is paid to the proportions of the several components, seldom does any failure occur, and then only in consequence of some intermixture with them, of which the manufacturer was not aware. For instance, a quantity of flint was supplied, which had been ground with a chert that contained an extra quantity carbonate of lime, and as this was not neutralized by an extra allowance of alumine, the regular heat of the biscuit baking fused most of the ware. Mr. Good, Burslem, had ware and saggars fused together, and the fireman was so astonished, that he ran away!

The greater the quantity of flint which can be used, the whiter is the ware, yet it must be duly proportioned, else the second baking will cause it to crack; and, although the weights are determined by the slip-makers, an endless variety of mishaps result from their blunders of *over* and *under flinting*.

The majority of manufacturers are not yet convinced of the bad policy of indulging the caprice of dealers, who, having paid according to a certain scale of prices, will not rise up to that which allow a fair profit on a superior kind of ware. Hence, cheapness of production

is too much regarded, and the excellence of the ware injudiciously sacrificed to economy, in the use of certain components which cost less of themselves, and need less baking; though it scarcely bears the usage of the warehouseman and packers;—acids and hot water affect the glaze, crazing ensues, and the article is deteriorated, and ultimately discarded. Now this is no trifling affair, for the worthlessness of any kind of ware, has depreciatory effect, by the stigma of all from that district; and, in the censures it causes, all manufacturers are implicated; it injures them, locally, by suggesting the idea of superiority in the manufactures of other potteries; and it is most prejudicial to them, nationally, by the unfavourable comparison when placed in competition with the continent of Europe and China.

Process and Manipulations in the Clay.—In preparing what is called the *body*, or by the workmen, the *clay*, attention is indispensable on the part of the manufacturer, that his slip-maker most carefully forms his several components into liquids with water, till the proper density, or weight per ale pint, is formed by adding material or water as requisite, as ignorance or carelessness on this point, is often the cause of serious loss. The first method of *combining clays*, was by placing them *stratum over stratum*, then exposing them to the action of the atmosphere, and by repeated working with the spade, intermixing them, until they were much disintegrated. After they were continued exposed some months, portions were taken and mixed in water in a square hole, bricked on the sides, with a strong wooden ridge-piece on one edge. This is called the *blunging pan;* and a *blunger* is used, formed from a stout ash plank, sawed blade-wise, the upper end having a cross-handle firmly fixed, and the blade diminishing from about eight inches by two, to six by one. This is forcibly shoved along the bottom, then rested on the upper ridge, and by pressing down the handle, the whole mass is agitated in the water, and so loosened that the pyrites subside. The watery mixture is poured through a hair sieve, upon a *sun pan*, or *sun kiln*, several feet square, a foot

deep, and the bottom sprinkled with sand. The fluid is poured on at successive times, and evaporates a little; afterwards it is cut out with a spade, and laid in a damp vault until used. *Slip-making*, is the process of preparing the clay for the present manufacture of china and earthenware. The slip-house is a long apartment, containing vats or arks for the flint, stone, or other minerals; and a slip-kiln formed of a long trough, eighteen to thirty feet long, three to five broad, and sixteen inches deep, in which large bricks, eighteen inches long, eight broad, and two to three and a half inches thick, (as nearer or not to the fire place,) are placed on bricks forming distinct flues beneath; and, for particular bodies, over all is run a coating, two inches thick, of plaster of Paris. The blunging pan is formed of flags placed edgewise, and the blunger is about seven to nine feet long, shaped as already described. The native clays are mixed in water by the blunger, till the fluid is of a certain density, per ale pint, and resembles thick cream, and then by bowkfuls is poured through a lawn sieve, into a large vat, (often carefully graduated,) until all the clay is brought into a state of proper comminution, and the mass of a definite weight per ale pint. To this is added the requisite quantity of ground flint in water, also of a certain density per ale pint; and then a complete intermixture of the whole may be effected, the fluid is pumped out of this vat, upon the slip-kiln, in its course passing through the finest lawn of the series used. By the heat from the flues the whole mass is kept in continued ebullition, until a considerable proportion of the water employed as the medium of the components is evaporated, and the cessation of air bubbles on the surface, and from the solidity of portions cut out of different parts of the mass on the kiln, the slip-maker considers it sufficiently dry, but not too dry, for properly yielding to the hand of the thrower, or the manipulations of the presser, in giving it the forms of the several articles. It is removed from the kiln into an adjoining apartment, and the process of *Slapping the clay* succeeds. A strong man, with a spade, not unlike a T inverted, from a heap

cuts off a small lump, and with much force casts it on another heap, to cool it by the exposure to the atmosphere, and temper it by destroying all air bubbles caused by evaporation on the slip-kiln. It is then carried into a vault until required by the workmen. Often, however, from want of capital, and of convenience, warm clay is taken by the workmen, after being only a few hours off the kiln, to the injury of the workmen as well as of the masters; the latter, though aware of this disadvantage, not resolutely opposing its occasional practice.

Throwing the ware is the first manipulation. Fitted into one nook or corner of the room, is a box, with a curved front, about four feet square. The *thrower's (engine or) wheel* consists of a spindle or axis, which turns vertically in a step, and is supported by a collar. On the upper end is firmly fixed the head, a circular disc of wood, which, during the operation, has horizontal motion. On the spindle, near the bottom, is a pulley, with grooves of varied diameters, for easing or increasing the force required for different vessels. In this pulley works a cord, which passes under a snatch-pulley guide to a wheel, three or four yards distant, placed near the wall, and from four to seven feet in diameter, moved by a wince.

In some manufactories, where steam-engine power is available, cones inverted are placed on parallel shafts, and a belt is adapted to them, which always is adjusted because of their similar but opposed dimensions. One of these shafts has a pulley on its lower end, from which passes a belt to the thrower's wheel; and the other is connected by proper gearing, with the moving power. The needed velocity for the thrower is obtained by the movable belt being higher or lower on the driving cone, from a directing lever.

At a strong bench or table, near the throwing wheel, is a *baller*, (usually a young woman,) with a large lump of the clay before her. This manipulation of *balling* is performed thus:—with a brass wire a piece of clay is cut off the lump, and with all possible force by the person

slapped down again on the mass; this laborious work she repeats, by cutting in different directions, until the intersected part presents a smooth homogeneous surface, without any appearance of air bubbles; because, were one of these left therein, its expansion, during baking, would spoil the article. She then cuts off a small lump, with thin brass wire, and *weighs* it, when the body is valuable and the vessels must be of a definite size; next she squeezes it well together, and forms it into a ball, which she hands to the thrower as he requires a supply. The *thrower* sits on a low seat in the corner of the box frame, with his feet on the sides of the disc or wheel head, and his arms resting on his knees, keeping steady his hands while they modify the clay into any required form. On the side of the frame he fixes in a lump of clay a peg, or stick, at that distance from the centre which indicates the height and expansion of the vessels he must throw. Taking a ball of clay, on the wheel being in motion, he casts it very forcibly on the disc or head, and to expel any air bubbles, forms it into a conical pillar twice or thrice; then inserting his hand, or finger and thumb, with the other hand on the outside, he gives it the rude figure of the vessel; and, with a *wage* or pattern (formed of earthenware, and well glazed) he smoothly finishes the inside, and then, with a brass wire, cuts it loose from the head. The baller then hands him another ball, and dexterously lifts the vessel off the disc, and places it on a board, on which it remains, (occasionally turned upside down,) until it is sufficiently dry to bear, without injury, the manipulations of *turning and handling*.

TURNING OF THE WARE.

The *turner's lathe* resembles that employed by mechanics, only the spindle is longer, and some of them have a collar, moveable by a catch, for the particular manipulation called *engine turning*. On the end of the spindle, outside the head-stock, is a screw, for the several chucks required by vessels of different sizes. A pulley with three grooves of varied sizes is also on the spindle, on which is the cord passed round the wheel, which is

fixed on a crank shaft. Connected with this crank is a treadle; and beside the frame which holds the spindle, stands the *treader*, usually a young woman, who, by a motion of one foot, keeps up the velocity required, and can perform some manipulations requisite, without the attention of the turner being distracted from the vessel before him. Near the treader is a board, on which are vessels to be turned, which she severally hands to the turner, as he requires a supply. Standing in front of his chuck, he fixes his vessel on it by a slight pressure with his tool, as the spindle has retrograde motion; then the proper motion being communicated, with a tool of soft iron, properly sharpened by filing, he takes off the superfluous quantity, and then the treader catches hold of the cord, and gives the spindle retrograde motion, during which the turner lays a broad tool on the vessel, and gives a certain polish to the outside; after which he applies a sharp tool to cut it loose, and then he places it on the board before him, for the handler if requisite, or to dry for being baked biscuit.

MOCHA, TORTOISESHELL, AND DIPPED WARES.

These are the common drinking cups, bowls, and jugs, which have parts of the outer surface brown, green, or yellow, with ornamental rings around them, formed by the *turner* in the following manner:—having rendered smooth and in shape the outside of the vessel, he immerses it in a proper mixture, or applies the fluid by a sponge, and places it to dry as he proceeds with others. Afterwards it is fitted on the chuck, and the parts which are to appear white under glaze, are *tooled* out; while others of various colours are formed by a mixture applied through a quill, from a globular vessel, into which air is blown to force the fluid out. With a sponge, there is colour applied to form one kind; and on others, a drop is let fall, of a saturated infusion of tobacco in stale urine and turpentine, and it ramifies into the resemblance of trees, shrubs, &c.

The following are the components of *Dips* and *Smears*:—

1. *Brown*, for jug necks,—Take and mix well twenty parts,

severally, of blue clay, yellow brick clay, Bradwell-wood clay, calcined ochre, and oxide of nickel, grind, and pass through a 12's lawn.

2. Calcine iron scales (from the smithy,) pick, pulverize, and pass through a sieve, hair, or coarse lawn; and mix one pound in one quart of earthenware slip (No. 4.)

3. Mix two ounces of fine zaffres in a quart of yellow brick clay slips.

Slate Dip.—Make earthenware turnings into a thick slip, cream-like, with water; then to seventy-eight parts of the slip, add twenty-two of fine zaffres.

Green.—In two quarts of unflinted earthenware slip, mix one pound of ground zaffres; evaporate, calcine, pulverize, and sift; then, in a quart of flinted slip, mix twelve ounces of the calx.

Dark Green.—In one quart of stone-ware slip, mix three ounces of zaffres.

Olive Green.—Mix black marl into slip, twenty-four ounces to ale pint; into three pints of slip mix four ounces of zaffres.

Olive Sponge Dip.—Mix one ounce of zaffres into a quart of yellow brick clay slip.

Blue.—1. Mix half an ounce of pure cobalt calx into three pints of stoneware slip.

2. Ball clay, twenty-eight; Cornish stone, fifty; plaster, twenty; blue calx, two.

3. Ball clay, twenty-three; Cornish stone, twenty-seven; flint, twenty-seven; china clay, fifteen.

Grey.—1. Best Slip, seventy-five; flint, fifteen; emery, sixteen; manganese, four.

2. Best turnings, ninety-four; saffre, six; in rain water only.

Orange.—Brown dip, fifty; black marl slip, fifty.

Cane.—Orange dip, fifty; best slip, fifty.

Red.—Brick clay slip, sixty; Bradwell-wood slip, forty.

By the manipulation of the *jigger*, great numbers of small articles are quickly formed, also plates of various sizes. A spindle is fixed in a step, and its disc is above the table or bench; while, from a pulley below, a belt

passes to another spindle, on the upper end of which is fixed a small wince, which is turned by a lad, while another forms his clay articles.

MODELLING.

This manipulation demands judgment and taste, as well as delicacy of execution. The *modeller* forms a correct model of the object, whether utensil or figure, and, when this is dry, one or several blocks are formed from it; and these are used by the *mould-makers*, to cast *moods*. With a thick layer of clay around the block, space is left, into which is poured plaster of Paris, and left some time for the water to evaporate, and the plaster to solidify for the required manipulations.

PRESSING OR SQUEEZING THE WARE.

The *presser* keeps all his moulds on shelves ranged in a room around a heated stove, which, by raising their temperature, promotes their absorbence of the moisture in the clay in contact. For convenience he has a number of moods for each kind of vessel or utensil. He regards the size and strength of each, and then cuts off a lump of clay sufficient for the purpose; and, after squeezing it in his hands, he beats it to a suitable size and thickness. Usually ten or more of these *bats* are prepared before proceeding to the next operation. Taking the several parts of this mood, he covers it with a proper portion of the bat, and bosses it on with a damp sponge, afterwards with his thumbs, forcing it into all the parts, however angular they may be. With a moistened sponge he carefully smooths the inner surface, then trims off all extra portions from the edges, which he moistens with *slip* (unevaporated body,) places all parts of the mood in proper contact, when needful, secures them by a belt buckled round, and then ranges the whole on the shelf round the stove, till sufficient moisture is absorbed to render the article capable of bearing, without injury, other operations. In small moods are formed ornamental figures, snips of jugs, spouts, handles, and various utensils. When the series of moods is filled, the presser empties them, again fills them, and while they are drying, with proper tools he

takes off all appearances of seams, trims up the articles, and applies whatever appendages are connected with his department.

HANDLING THE WARE.

This is a distinct branch of the *clay-man's* manipulations, and regards fixing on vessels the handles, spouts, snips, and ornamental figures proper for them. Many of these are formed in moods, as by the presser; the handler having a number in his charge, ranged around the stove for use. But for common vessels, a *box and screw* is used to supply lengths of clay of a certain form, as required. An iron cylinder is secured to a block fixed in the wall. Into this cylinder, at the bottom, is placed a piece of lead, perforated agreeably to the intended shape of the clay-length; and for tubes, it has a steel round pin firmly placed in the centre of the lead; a piston of iron is adapted to the cylinder at the end of a powerful screw, which works through a bar above, by a cross handle. Into this cylinder is put a lump of clay, and the force of the screw on the piston causes the clay to pass through the lead-piece, and it is received on a board, until all is pressed through; and these lengths are left a short time to dry. The handler then cuts them in sizes, places them in a proper curve, and prepares his vessels by trimming them. Having his handles, snips, and spouts before him, with a sharp knife he cuts their edges level, also the cylindrical side of the vessel, then cuts out the place for the snip, or the aperture for the spout; next moistens all the edges with slip, fixes them properly, leaves them a few minutes, examines and corrects any defects, and after some time trims them, and lets them remain until ready for being baked biscuit.

MAKING OF THE WARE-BISCUIT.

The potters' oven for biscuit is usually larger than that for glaze; and is, in form, a cylinder ten or twelve feet high, and from ten to fifteen feet in diameter, surmounted by a dome from three to five feet in height, in whose centre is an aperture about two feet in diameter. The firebricks used are made of the shale marl, carefully

mixed with slate clay; and the exercise of judgment in this mixture is well compensated by the demand for more serviceable bricks. In erecting the oven, the builder lays the bricks, not in lime and sand mortar, but in a mixture of fire clay and sharp sand with water, or China clay and a weak solution of borax in water; making the joints so close and compact with this lute, that the first baking of ware therein causes the whole interior to become one compact shell of vitrefied fire clay, precluding any admission of air into the interior, except through the mouths; which, and also the bags or flues, are carefully adapted in size, so as to prevent a continual current of atmospheric air carrying off through the dome a portion of the heat which ought to be appropriated by the air in the oven. The *mouths* on the outside are from four to ten, according to the size, and communicate with *flues* in the hearth of the oven, and *bags* of bricks, placed edgewise, leaving an aperture of a few inches, fixed to the inside of the cylinder; between each of which, in the cylinder, is left a small hole, from which the fireman, by means of a long iron rod, can draw his trials out of a saggar placed opposite, or through which he can inspect the gradual rising of the temperature of the oven, and its remaining at a certain heat during the time required for earthenware, till the "heat will expel the moisture and agglutinate," as stated by Vanquelin, "the components, without effecting the fusion, which would render the ware so momogeneous as to become brittle." But, for the best or hard china ware, the temperature is raised till there is a semi-vitrescence of the components, calculated to be 80° to 100° Wedgewood, as the earthenware is 45° to 65° W., and that for the glaze 10° or 7-5° lower. Felspar ware 115° W. Dr. W. Henry assigns others to different china wares:—Worcester, probably Flight and Barrs', 94°, Chelsea 105°, and Derby 112° Wedgewood.—Here let it be understood, that the *Wedgewood Pyrometer* is no longer to be obtained, and the real cause has not been assigned. This pyrometer was invented by Thomas Massey, (a bailiff in Mr. Wedgewood's manu-

factory,) to determine the respective temperatures of the biscuit and glaze ovens, and of the enameller's muffles; but he most resolutely declined communicating to Mr. Wedgewood the components of his *dods*, (or trial prisms,) and was prevented informing his brothers, Richard and William—the real secret died with him. Mr. Wedgewood *guessed* at a clay for the purpose, and supplied philosephers therewith, till its inaccuracy was exposed by Guyton Morveau. Chemical reaction had completely affected what useful properties for the purpose previously existed. When the ware is so dry as to appear of an ash-grey colour, the several articles are placed within each other carefully, in *saggers*, (probably from the Hebrew *sagar*, to burn, and hence applied to a rolled leaf of tobacco used for being *burned*, while the smoke is inhaled); the shape is usually that of a lady's band box, though for plates round ones are used, and some have triangular holes inside in three double rows, for inserting stilts to keep the flat pieces separate. They are formed of shale clay, (can marl,) sixty-seven; slate clay, (black marl,) thirty-three, well beaten together; or of ground biscuit earthenware, sifted, and mixed with black marl; then formed into bats one inch thick, and placed around a drum of the shape and size required, mostly twenty inches long, and oval in shape, and a bottom bat is fastened by working the edges together. To prevent the articles adhering from accidental excess of heat, pulverized grit-stone is introduced between the ware and the sagger bottom; and the best china, jasper, pearl, &c., are imbedded in ground flint, as a matrix, to prevent *wauving*, (waving or altering the shape and figure,) which might possibly ensue from high baking. The saggers are filled as full as they will contain, and then are piled on each other in vertical *bungs*, each edge of a sagger being coated with a thick *wad* of coarse brick clay or marl, and on which the next upper sagger is imbedded; and the whole pile resembles one compact mass, secure from any deleterious effects of the carburetted hydrogen, or sulphureous vapours evolved by the fuel. In different parts of the oven are pipe-saggers, to pro-

mote the regularity of the baking; and opposite the aperture, between the bags, is a sagger with its side perforated, and containing the *trial pieces*. When the oven is filled, and all arranged, the door-way is built up with bricks, and plastered over with mud, and short iron bars are hooked into an iron frame that goes along the edge of the door-way, and is connected with two or three ranges of very strong hooking-pieces of iron, that go round, like hoops, one at the commencement of the dome, and two others on the cylinder, and which guards are necessary to prevent the high temperature of the whole causing the cylinder to crack or bilge out. After the first eight hours, the baking continues of a regular heat for about thirty-five hours more, and then is rapidly urged on for three hours longer. An experienced fireman will judge with tolerable accuracy of the process of baking, by the appearance of the saggers, and by inspection of *trial pieces* made of brick clay, in the shape of rings and small gallipots, taken from different parts of the oven, and which present a varied tint at different degrees of temperature, compared with a trial known to have been properly baked, and kept as a standard for determining the process. When the fireman knows the nature of the coals he uses, he will frequently save to his employer, (in addition to the production of superior ware,) the consumption of coals exceeding the amount of his wages. When the baking is completed, the *mouths are drawn* (the fuel is extracted) as quickly as possible; the whole is left to cool for several hours, (the entrance is opened,) *the clammings* are taken down, the saggers are emptied as quickly as possible into baskets, and carried into the sorting room, where they are carefully examined, and by *sounds* tried whether fit for further processes, and when so, placed in the biscuit warehouse; as *good*, when perfect; as *seconds* when slightly injured, yet sound; and, as *lump*, or *thirds*, when defective, yet sound in structure. All *cracked* articles are cast aside on the *shord-rack*, (heap of *pot sherds*.) The expansion and contraction of the mass expediting the destruction of the oven, manufacturers

strive to keep their clay stock up, so as constantly to supply ware, without allowing the oven to be lower than is absolutely proper for the men to bear while drawing, and again setting-in. The earthenware, in its biscuit state, has a dry and gritty roughness; the china, a resemblance to statuary marble, devoid of any lustre on its surface; but, when of a good body, and excellent workmanship, as vases, busts, figures, and models, all the edges and tooling remain as sharp and clear as in fine sculpture. There is a great probability that the sight of the biscuit china, suggested to Mr. G. Cumberland, of Bristol, the idea of manufacturing *tiles* of a body of clay and ground silica; by pressing linen of different fineness upon the clay, for the formation of the teeth, and then baking them till vitrified. (Vide Nicholson's Journal, 8vo., vol. xxv., p. 257.) Slight inspection of biscuit ware will suggest, and its bibulous nature on immersion in water will demonstrate, its porosity, rendering it inconvenient for containing fluids, and easily destructible by decomposition; yet properly adapted to retain the fluid medium of the components of the *glaze*, which has been employed from earliest times to assist the durability, and improve the general appearance. The thin fabric of most vessels, as well as the components of the body, will not allow the fluid glaze to be applied while they are in the clay state, as the water would cause the shape to alter, and either sink beneath its own weight, or bilge out and burst. English china, as at present compounded, if attempted to be formed by once baking, would so contract in the body as not to appropriate all the glaze which would be in ridges on the surface. And this will apply to any china whose components of the body greatly differ from those of the glaze. When the most ready employment of felspar in body and glaze becomes generally known, then will English china, probably, be made at one baking.

Ornamenting biscuit ware is accomplished by *painting* and *printing*, with the distinction of *blue*, because that colour was first employed; though now, in both branches, most other colours are used.

Blue printing, or *biscuit painting*, is now practised on only very common earthenware; and in rude patterns, traced by camel-hair pencils. on the surface of tea-ware and jugs. The colours for this manipulation are thus prepared:—

Brown.—(Fritts.)

No.	1	2	3	4	5
Litharge	48	30	60	42	22
Antimony, Crude	18	14	30	....	....
Manganese	12	14	10	17	20
Glass of Antimony	18	....	....	41	50
Zaffres	4	42	....	....	nitre 8

Blue calx, 9 or 8; fritt, 91 or 92.

Red Brown.		*Purple Brown.*		*Purple Brown.*	
Manganese	62	Manganese	45	Peroxide of Iron	15
White Lead	12	Red Lead	50	Flux*	85
Glass	7	Blue Calx	5		
Flint	12				
Borax	7				

Yellow Calx.			*Orange.*	*Nasturtium.*		
Litharge	17	48	46	Chromate of Lead		24
Crude Antimony	17	36	30	*Flux. Glass	10	38
			Crocus.	*Flux. White Lead	3	
Lead Ashes	33	..	16	†Flux. Glass	3	38
Tin Ashes	33	16	8	†Flux. Red Lead	2	

Naples Yellow.		*Greens.*		*Yellow.*	*Blue.*
White Lead	75	Yellow Calx	60	10	5
Oxide of Antimony	14	White Enamel.	20	11	11
Mur. of Ammonia	7	Red Lead	13	40	42
Sulp. Potass and Alumine	4	Flint	—	14	14
		Copper Calx	—	4	7
		Blue Calx	7	..	..
		Borax	—	9	9
		Glass	—	12	12

For enamel use 12 flint, and 6 copper.

Blue for Edging.					*Brown for Edging.*				
No.	1	2	3	4	No.	1	2	3	4
Flint	13	30	5	..	Brown (Fritt 1.)	60	37	70	65
Glass	20	20	30	32	Orange (Fritt)	6	4	11	10
White Lead	10	..	30	40	Glass	30	32	4	8
Fritt	37	10	10	..	White Lead	4	27	..	5
Blue Calx	20	40	25	28	Flux†	..	..	15	12

Blue printing is the name for the manipulations of taking impressions (in colours, blue, green, pink, and brown,) from copper-plates engraved in a style peculiar to the artists of the pottery districts; and of sizes varied to the different vessels. The press is made very strong and large, similar to that used for beautiful copper-plate printing for embellishments; usually with cast-iron cheeks and rollers, and an iron lever, not a cross. The press is placed within four feet of a stove-plate, kept constantly heated, that when the copper-plate is laid thereon, its engravings may more easily admit the colour as it is rubbed over it. The printer has his thumb and finger protected by a thick slip of leather, and cleans his plate from the scalding colour with a stuffed leather boss, not his hand, as other copper-plate printers.

The *blue* colour is blue calx, 37; flint, 42; nitre, 6; borax, 15; well ground together; (and in similar proportion for other colours;) the tint being heightened or lowered by the quantity of the calx.

Brown.—Litharge, 37; crude antimony, 37; manganese, 18; and blue calx, 8; calcine and grind well together for use.

Black.—Red lead, 60; antimony, 25; manganese, 15; calcine, then grind with blue calx, 40; oxide of tin, 5; and calcine for use.

Mulberry.—Manganese, 54; blue calx, 26; nitre, 14; borax, 6; calcine over pulverized nitre; then grind well with glass, 18; flint, 10; for use.

The colour is well mixed on a very hot iron plate, into a fluid, called technically an *oil*, prepared thus: over a slow fire, in a vessel kept loosely covered, for two hours boil one quart of pure linseed oil, then add one pint of pure rape oil, and two ounces of capivi balsom, and boil two hours longer. When a little cooled, (to 160°) add, of amber oil, white lead, and clean pitch, severally half an ounce; resume the boiling, and continue forty-five to seventy-five minutes, according to the strength of tint for which it is wanted. Some printers prefer to the latter ingredients, one ounce of oil of tar, and one ounce of balsam of sulphur, very carefully introduced, else the whole will be spoiled by coagulation.

The printer places his plate on the stove, rubs in the colour, with a broad pallet knife scrapes off the excess, and then with his boss cleans the plain sides, and places it on the bed of his press; he next brushes the sheet of tissue paper over with a solution of soft soap and water, puts it on the plate, rolls it between the rollers, and the instant the return of the press leaves it dry by the hot plate, he carefully takes it off, and examines that the impression is a good one, and that the colour properly adheres. Thus he proceeds till his quantity is taken off. Messrs. Machin and Potts, Burslem, under the security of a patent, use *engraved rollers* for the purpose, instead of plates. Their machinery is, at present, not exhibited to strangers; but the suggestion seems taken from

calico-printing, with which branch Mr. Potts was some years connected.

A *cutter* (a little girl, training up for the next manipulation,) takes the impression, cuts away all the white paper, then separates the impression into its parts, which she places in the order most readily facilitating their application to the ware.

A *transferer*, with considerable tact and judgment, places on a biscuit vessel the several parts in their proper arrangement; and then, with a rubber of flannel, six to sixteen inches long, and firmly rolled and tied together, with the ends a little loose, she rubs the paper upon the article, with much force, often resting one end in the right arm-pit, until it cannot again be taken off. The dry and absorbent porosity of the ware aids the adhesion of the colour in the oil, and when the task is completed, each vessel is taken off the board on which it was placed by the transferer, immersed in water, and and with soft water and a sponge the paper is washed off, and leaves in the ware only the mineral colour, and a little of the oily medium. The ware is kept in a heated room to evaporate much of the water imbibed in washing off the paper, which is requisite to prepare it for the fluid glaze; and also, is heated to red heat, to *harden on* the colour, and volatilize the oily particles, else the glaze would not adhere.

BAKING CHINA AND EARTHENWARE, GLAZED.

The porous nature of vessels baked only biscuit, would allow many fluids to permeate, which being an inconvenience, while it facilitates their destruction by decomposition, the necessity of an impermeable covering, is provided for in a glaze; and this has been attempted to be effected by several different processes.

When common pottery was manufactured in Staffordshire, the dust of lead ore was shaken from a bag, on the outside, in the clay state, and afterwards manganese was mixed with it. Glazing with salt was the next improvement, and then washing; and, finally, biscuit-dipping. For some years, only *raw glazes* were used; their components only being mixed, without fritting, prior to

grinding; but, as the desire for improvement increased, the method adopted to make glass and vitreous colours, suggested the practice of *fritting* the components. There is a physical necessity for the components of the glaze to be adapted to those of the body, which is varied according to the judgment or opinion of the manufacturer. The degree of expansion and contraction depends on the density and compactness of the body, which must be carefully regarded, or the glaze which appears fine on one body, will seem defective, and craze on another; the temperature requisite for fusion of its components, may be lower than will bring the surface of the ware into a suitable state for combining therewith, and consequently, they would intumesce, be devoid of lustre, craze, and scale off; or, it might be higher than the body will sustain, which being too much contracted, the glaze might lie in streaks; or, it might wauve, and being rendered, by the alkaline components, more fusible, at a higher temperature than biscuit baking, the whole might sink into one vitrified mass, as too often occurs.

The *china glazes* have these *raw* components:—

No.	1	2	3	4	5	6	7	8
Cornish Stone	25	35	32	20	15	40	30	25
Red Lead	30	30	40	23	44	18	20	45
Borax	18	3	....	19	6	....	8	....
Flint	12	14	7	16	15	12	14	14
Glass	10	17	20	12	18	30	22	12
Soda	3½	....	....	6	....	....	3	....
Tin Oxide	....	....	....	3	....	....	1	2
Blue Calx	1½	1	1	1	2	....	2	2

These are substitutes for *felspar*, as *raw* glazes:—

No.	1	2	3	4	5	6	7
Cornish Stone	40	28	50	29	30	42	40
Glass	....	24	....	29	30	....	27
Flint	28	16	....	....	....	....	11
Borax	22	....	....	....	....	....	11
Potass	....	14	12½	21	10	20	....
Nitre	....	2	....	....	....	....	11
Soda	20	....	....	....	....	....	....
Red Lead	....	16	....	....	....	....	....
Lime	....	....	37½	7	30	38	....
Lynn Sand	....	....	....	14	....	.....	....

When borax is very expensive, this is often substituted: subject equal weights of nitre and flowers of sulphur to heat, till all sulphurous acid gas is dissipated; then pour on an iron plate, and, when cold, take off the greasy scum, and use the remainder.

These are the *fritted glazes*, in proper succession:—

1. *Fritt.*—Flint, 54; lead, 17; glass, 17; nitre, 9; borax, 3.—*Glaze.* Fritt, 50; lead, 20; glass, 22; flint, 8.

2. *Fritt.*—Cornish stone, 36; glass, 28; flint, 25; borax, 11.—*Glazes.* Fritt, 80, 60, 84, 72, 76, 78; lead, 20, 40, 16, 28, 24, 22.

3. *Fritt.*—Cornish stone, 22; glass, 20; flint, 18; borax, 6; potass, 18; salt, 12; nitre, 2; china clay, 2.—*Glaze.* Fritt, 80; white lead, 20.

4. *Fritt.*—Cornish stone, 21; glass, 21; flint, 21; borax, 5; potass, 16; salt, 12; nitre, 2; china clay, 2.—*Glaze.* Fritt, 80; white lead, 20.

5. *Fritts.*—Glass, 76; red lead, 7; potass, 7; arsenic, 4½; nitre, 5½; glass, 47; potass, 53. Grind together.—*Glaze.* Fritt, 80; lead, 20.

6. *Fritt.*—Cornish stone, 82; flint, 9; nitre, 9. Grind well together.—Fritt, 50; glass, 30; flint, 20.—*Glaze.* Fritt mass, 50; lead, 45; flint, 3½; potass, 1½.

7. *Fritt.*—Cornish stone, 44; glass, 30; flint, 18; borax, 4; nitre, 4.—*Glazes.* Fritt, 44; cream-coloured glaze, No. 2, 56; fritt, 60; white lead, 40; fritt, 78; white lead, 22.

8. *Fritt.*—Cornish stone, 31; glass, 38; borax, 31.—*Glaze*. Fritt, 80; lead, 20.

9. *Fritt.*—Glass, 75; red lead, 15; arsenic, $4\frac{1}{2}$; nitre, $4\frac{1}{2}$; black calx, 1.—*Glaze.* Fritt, 28; cornish stone, 20; glass, 22; white lead, 30.

10. *Fritt.*—Cornish stone, 80; soda, 20.—*Glaze.* Fritt, 40; Cornish stone, 20; flint, 15; white lead, 25.

11. *Fritt.*—Glass, 84; flint, 10; red lead, 4; arsenic, 1; nitre, 1.—*Glaze.* Fritt, 25; Cornish stone, 30; lead, 25; flint, 16; borax calxed, 4.

12. *Fritts.*—Glass, 72; red lead, 22; arsenic, 3; nitre, 3; glass, 97; blue calx, 3; grind together.—*Glaze.* Fritt mass, 20; Cornish stone, 25; flint, 10; white lead, 45.

13. *Fritts.*—Glass, 48; Cornish stone, 24; red lead, 20; flint, 5; nitre, $1\frac{1}{2}$; arsenic, $1\frac{1}{2}$.

Glass, 73; Cornish stone, 12; red lead, 9; black calx, 2; nitre, 4.—*Glaze.* Glass, 26; Cornish stone, 30; fritt, 36; white lead, 5; potass, 3.

These are the *fritted* Felspar glazes:—

1. *Fritts.*—1. Lynn sand, 54; soda, 46.
2. Flint, 64; soda, 36; and,
3. Lynn sand, 70; soda, 18; China clay, 22.

Glaze. Fritt mass, 10; borax, 30; Felspar, 60.

2. *Fritt.*—Felspar, 90; carb. barytes, 7; carb. lime, 2; magnesian clay, or steatite, 1.

Glazes.—1. Fritt, 64; borax, 26; nitre, 5; potass, 5, for printing; and substitute 4 of salt for 4 of borax.
2. Fritt, 58; borax, 39; nitre, 3.
3. Fritt, 62; borax, 38.
4. Fritt, 60; borax, 36; nitre, 4.

3. *Fritt.*—Felspar, 52; borax, 34; nitre, 8; soda, 2.—*Glaze.* Fritt, 60; borax, 40.

4. *Fritt.*—Felspar, 50; borax, 24; Lynn sand, 8; China clay, 6; nitre, 6; potass, 6.—*Glaze.* Fritt, 62; borax, 32; nitre, 6.

Fritts.—Felspar, 40; China clay, 20; salt, 16; lime, 8; magnesia, 8; barytes, 8.

Flint, 50; soda, 25; potass, 25: grind together.

Glaze. Fritt, 60; borax, 32; nitre, 8.

The *raw* glazes for earthenware, have these components:—

No.	1	2	3	4	5	6	7	8	9
White Lead...	48	25	50	56	50	....	....	60	58
Flint	14	20	14	15	11	15	....	18	....
Cornish Stone..	23	30	25	30	26	27	39	22	42
Ground Glass ..	15	20	11	....	13	10	....	....	....
		Borax							
Litharge	..	5	....	....	....	48	61	....	....

The *fritted* glazes have the following components:—

1 *Fritt.*—Glass, 69; litharge, 18; nitre, 8; arsenic, 4; blue calx, 1.—*Glazes.*—For *printed.* White lead, 54; Cornish stone, 26; flint, 14; fritt, 6. Flow with rock salt, and pearl ashes.—For *enamel.* Litharge, 55; stone, 25; flint, 15; fritt, 5.

2. *Fritt.*—Glass, 70; litharge, 22; nitre, 4; arsenic, 4; blue calx, 1.—*Glazes.*—Printed. Fritt, 12; flint, 20; Cornish stone, 23; litharge, 45.—*Coloured.* Fritt, 18; flint, 10; Cornish stone, 25; white lead, 48.—*Mocha.* Fritt, 13; flint, 11; Cornish stone, 26; litharge, 50.—*Cream colour.* Fritt, 30; crown glass, 20; flint glass, 50.

3. *Fritts.*—Flint, 87; borax, 13:—also, glass, 84; red lead, 8; nitre, 3; salt, 5.—*Glaze,* for *enamel.* Fritt, 22; Cornish stone, 25; white lead, 28; blue calx, 1.

4. *Fritts.*—Red lead, 20; glass, 68; arsenic, 5; nitre, 5; blue calx, 2.—For *flatware.* Lead, 14; flint, 50; borax, 23; nitre, 12; blue calx, 1.—*Glaze.* Printed. Fritt, 80; white lead, 20.

5. *Fritts.*—1. Glass, 92; white lead, 7; blue calx, 1; also,
2. Glass, 68; red lead, 27; arsenic, 5; then grind
No. 1, 20, No. 2, 80, for printed teas or jugs; or
25, 75, for flatware.
—*Glaze.* Fritt mass, 16; Cornish stone, 27; flint, 10; white lead, 47.

6. *Fritt.*—Glass, 52; red lead, 18; arsenic, 12; nitre, 12; borax, 5; blue calx, 1.—*Glaze.* Fritt, 20; white lead, 50; stone, 24; flint, 6.

The *coloured glazes* have these components:—

Black.—1. *Shining.* Calcine flinted slip, 60; red lead, 40; mix calx, 86; good manganese, 14: grind together.

Or, 2. White lead, 66; manganese, 26; flint, 10: grind together.

Brown.—1. Raw glaze, manganese (No. 1) 33, fritt glaze (No. 3), 67, for printing.

2. Raw glaze, manganese (No. 1), 67; fritt glaze (No. 3), 33; for jug necks.

3. In best slip, 33; flint, 5; red lead, 62.

Manganese, 2, will make this *black*.

Green Fritts.—1. White lead, 54; flint, 27; blue clay, 9; copper calx, 9; blue calx, 1: grind well.—*Glaze.* Fritt, 15; No. 2, raw glaze, 85.

Fritt. 2.—White lead, 33; copper calx, 28; glass, 17; flint, 22.

Glazes.—Fritt, 26, No. 4, fritt glaze, 74: for *desert* ware.
Or, do. 20, 80, for *printed*.
Or, do. 40, 60, for *edging*.

Yellow.—1. Yellow calx, 14; litharge, 14; fritt glaze (3), 72.
do. 20, raw glaze (2), 80.

The components of a glaze should be, by chemical affinity, adapted to fuse together, and flow equally, (not in streaks on one part, and without lustre on another,) readily combining with those of the body, without affecting the contraction of the vessel, during the baking; and when cold, present an opaque covering of cream colour; but for ornamental wares, china or earthen, the glaze must appear clear, free from specks, or bubbles, resemble velvet in softness to the eye, resist acids and alkalies, and bear sudden rise of temperature. They also must mix with water, to the denseness and resemblance of thick cream, but not thicker than be, on the water being imbibed by the ware, a thick coating, which when dry, will bear being placed in the saggers, without a portion rubbing off. The *fritt glaze* is ground to an impalpable powder; and then mixed with those com-

ponents which are used raw, in the same manner as *raw glazes* are mixed,—by a hand-mill, not unlike a circular washing-machine, and then put into a dipping tub.

To prevent the more ponderable components *precipitating* and the deficiency leaving almost a mere wash for use, constant stirring is kept up; and there is a certain quantity of common salt, for raw glazes, (and of muriatic acid for fritt glazes,) mixed therewith, to preserve the density of the medium. The DIPPER receives from a boy each article, which he immerses, and by a peculiar movement of his hands causes all the surface to be equally yet thinly covered; he then places it on a board, on the points of nails, and the unappropriated fluid drains off, and when dry it is placed in saggers for *glaze baking*.

The dipped vessels, when moderately dry, are placed within saggers, and by *stilts*, *triangles*, *rings*, *pegs*, and *cockspurs*, kept asunder, to prevent their adherence when the glaze flows, and to allow all the materials of glaze and body to be properly annealed. The temperature is a white heat of all within the oven; and, when the trials indicate complete vitrescence of the glaze, the fires are quickly drawn, and the whole is left to cool, ready for the warehouse.

ORNAMENTING OF GLAZED WARE.

This includes *black printing*, *lustering*, *and enamelling*.

Black printing is the term for applying impressions to glazed vessels, whether the colours be black, red, or gold. The copper-plates are engraved in a style differing from those employed in *blue* printing; and the colours are different in components and preparation.—The following are the components of the colours:—

Black.—1. Copper calx, 20; flux, (†) 80.

2. Copper calx, 25; flux, (*) 75.

3. Calcined borax, 46; calcined umber, 35; blue calx, 9.

4. Do. do. 25; do. 75, for gilded ware.

The *green*, *purple*, and *pink*, are the enamel colours fluxed a little more, with flux. (†) Instead of using

paper for taking off impressions, the black printer employs glue bats, prepared in this manner:—A definite quantity of good glue is soaked well some hours in water; it is next put into a large jug, and by the heat of boiling water evaporated during four hours; afterwards it is poured out on large well-glazed flat dishes, to the thickness of one-eighth of an inch, and left to cool. The glue is next cut into pieces, technically called *papers*, corresponding in size to the plates. The printer rubs his colour, in the state of an impalpable powder, well in a saucer, with a lock of carded cotton, well dried. He, with rosin, fixes his plate to a wood prism, as a handle, then rubs into the engraving his *oil*, (a mixture of cold-drawn linseed oil, and oil of turpentine, or Barbadoes tar,) and, with much pressure, the glue paper abstracts the oil out of the engraving, and being immediately laid carefully on the ware, previously wiped very clean, the oil, by a gentle pressure, adheres; he next with a sponge cleans the paper, and leaves it to dry, while he applies the powdered colour, by the cotton to the oiled design. With a series of papers he proceeds successively till his complement of ware is finished; and afterwards, commencing with the vessels first printed, with silk rags he cleans off all the superfluous colour from the design, and wipes all the other parts clean from whatever might be likely to adhere to the glaze while being baked in the muffle.

LUSTRED WARE.

The body is usually formed of common brick clay, 60, and blue clay and black marl, 20 each, blunged well, and properly lawned; fired biscuit, and then covered with the brown glaze, No. 3.

The components for the lustres are thus combined:—

Gold.—In nitro-muriatic acid, sufficient, dissolve,
Gold, 120; grain tin, 5: mix with (by heat)
Balsam of sulphur, 60; spirits of turpentine, 40.

Drop the acid solution in while stirring the medium; and when well mixed, use with best turpentine only. 1 ounce of gold makes 32 of lustre.

Persian gold lustre.—In fat oil on a tile, placed on a hot stove, mix dry oxide of gold, and when eliquation commences, stir with palette knife, and add more oil till 25 be used, and the colour resemble that of balsam of sulphur; then diminish the temperature, and gradually add turpentine, 75.

Silver, or *Steel Lustre.*—In muriatic acid, concentrated, dissolve platinum till the acid be saturated. Then at 112° Fahrenheit, to 25 of solution, add very carefully, and in small doses, 75 of spirits of tar. The chlorine will be evolved by the heat, and the chloride of platinum will remain in the tar. The metallic composition is applied to the ware by broad hair pencils; and this last, baked in a muffle, at enamelling heat, is *steel* lustre. Then in water mix the oxide of platinum, (obtained by sal ammoniac precipitating it from the acid solution,) and cover the steel lustre; again bake, and it will be *silver lustre*. If the glaze be opaque, not brown, this latter will at once give *silver lustre*. The gold lustre is used with turpentine similarly; and, recently, a new kind has been in the market, of whose components we have not yet been able to obtain determinate knowledge.

The *Muffle* for baking ornamented glazed ware, is of a size in proportion to the quantity usually in demand; and is constructed so as to prevent any vapours entering from the fuel. Considerable judgment is requisite for properly placing the different articles in the kiln; but this is the general principle:—the lustres are least liable to injury by baking; the rose colour, purple, cornelian red, pomona green, and gilt for burnishing, have a central situation; around them are placed articles in colours less affected by fixing oxygen. A layer is placed, with props fixed in different parts; on these, bats of half an inch thickness and 20 to 30, by 12 to 16 surface, are laid all the length; and ware placed therein: repeating this arrangement till the whole is filled, and then the aperture is closed and the baking commenced, and continued until the colours appear properly combined with the glaze; which the fireman ascertains by inserting a bit of deal stick in the kiln, and its white

flame renders obvious all the colours on the ware. When this is completed, the fire is withdrawn, and the whole left to attain the temperature of the air. The contents are then taken out carefully, and the gilded articles taken into a proper room to be *burnished* with agate, and blood-stone, and then carried into the warehouse to be wrapped in tissue paper for the market. In every process herein detailed, confidence may be placed. Why persons communicate *false recipes*, I hesitate to assert; but certainly whatever be the satisfaction in supplying correct information, in equal proportion must there exist self condemnation for wilfully misleading those who are seeking information. Ignorance is not a sin. Where I have not understood the process, I have avowed its being unknown to me.

ENAMELLING OF CHINA AND EARTHENWARE.

This art of executing designs on the glazed surface of ware, with colours so vitrifiable as really to acquire lustre at a moderate heat, or cherry-red heat, without complete fusion, has only been practised about eighty years in potteries. The colours, or enamels, are formed of a transparent and fusible glass, which has metallic oxides chemically combined to impart the necessary tint. The oxide of gold is used for purple and rose colours, also for a beautiful lustre; that of silver for yellow; cobalt for blue; copper for greens and blacks; antimony for yellow; umber for black and brown; platinum for steel and silver lustre; manganese for violet; chrome for cornelian red, and pomona green; and iron, in different states of red, brown, and black. A little more detail may not be improper in reference to some of the preparations.

The *Enamel Purple* is thus prepared:—In a large bowl of warm water, (112°) mix well a certain quantity of acid solution of nitrate of silver; then carefully add the equivalent of muriate of tin, and continue stirring the fluid half an hour; then add boiling water, till quite insipid; leave the fluid twenty-four hours to rest, and then with a siphon draw off the water, without disturbing the precipitate. Into this water stir a saturated

solution of muriate of ammonia, that any oxides left may be precipitated; or hydro-sulphuret of ammonia. For use, the precipitate is ground with 30 to 45 parts of flux; of red lead, 7; borax, 10; flint, 2.

The *Rose Colour*.—In water just below boiling, (190°) 90 parts, mix 10 parts of saturated solution of gold; then precipitate by plus of muriate of ammonia, of a yellow tint; let the precipitant be added at different times for twenty-four hours, and then rest twelve hours for all to go down, with a siphon draw off the water, as in purple; add boiling water till insipid Dry the precipitate on a plaster bat;—but, being fulminative, must be kept quite cold, and not be triturated until mixed with flux. The flux is, a fritt of flint, 38; borax, 32; red lead, 28; glass, 2.—Grind well with silver, 1; to precipitate, 9; and flux 30 to 40 parts.

Red.—The peroxide of iron, by calcining copperas over a fire, and frequent washing. For use, grind calx, 25, and 75 of flux; a fritt, glass, 66; red lead, 25; borax, 9.

Brown.—*Dark*.—Brown oxide of iron, 30; flux, 70; fritt, glass, 86; calx, borax, 14.—*Light*. Calx umber, 14; yellow calx, 14; peroxide of iron, 6; flux (red), 66.

Purple Distance.—Purple, 12; manganese, 18; flux, 70.

Green.—*Blue*. Sulphate of copper calcined, 20; flux, 80.—Fritt. Borax, 16; white enamel, 16; red lead, 50; flint, 18.

Green.—*Grass*. Blue green, 77; enamel yellow, 23.
Yellow. do. 66; do. 34.

Yellow.—Naples Yellow, 33; flux, 67. See *Green*.

Orange.—Naples Yellow, 25; biscuit orange, 25; flux, 50.

After being properly dried, and ground at a mill, each colour is ground on a very hard stone, or glass plate, and afterwards used with spirits of turpentine, and hair pencils.

That the enamels may answer, the glaze must correspond therewith, else the dilution will cause a design,

apparently finished, to come out of the muffle a mere sketch; while the flux must bake at the same heat as the glaze, to preserve the brilliancy of the metallic base, and neither craze, nor scale off.

The repetitions of the artist's efforts are indispensable to the finished appearance of many designs; which only by several bakings can receive that softness of colouring, and unfading brilliancy, which are essential to their elegance and full effect. The softness of the glaze during baking allows the metallic base to be imbedded therein, and when cold to be smooth and brilliant. The alkaline glazes, on this account, are only excelled by that of felspar, which in baking, receives the colours, and improves their tints.

GILDING OF CHINA AND EARTHENWARE.

This manipulation, (in which, as well as the preceding, there is opportunity for displaying the greatest taste,) employs hair pencils and oil of turpentine, with a preparation of the proto-muriate of gold, (obtained by dropping muriate of gold into a solution of caustic potass.) ground with 1 sixth part of mercury in oil, and applied at the pleasure of the artist.

Ground laying frequently adopted prior to gilding; and is thus effected:—Well boiled linseed oil, turpentine, and red lead, as a fluid, the artist lays even all the proper parts of the ware, by a pencil of suitable size. He then with a lock of cotton applies the powder of the enamel colour, with one-tenth additional flux; and carefully adjusts the coating, so that all the parts may be equally covered. This is then baked in the muffle, and consequently gilded.

APPENDIX.

As the present little volume is gotten up more for *instruction* than for *profit*, we take the present opportunity of laying before the reader the contents of one or two manuscript recipe books, now in use at some of the manufactories of these districts. The highly orderly manner in which these books are arranged, will not fail to excite a smile on the features of most who claim the least character for literary acumen. Nevertheless, as we know, that *much* that is valuable is mixed up in admirable confusion, with *some* that is worthless, and as to take from, or re-arrange, the said books would be to destroy their *character*, we prefer giving them in what might be termed the original text; leaving it to the sagacity of the reader to extract the sterling mettle from the dross that may surround it. To this end, we submit for perusal,

THE RECIPE BOOK OF BAILIFF THOMAS.

PURPLE UNDER GLAZE.

$\frac{1}{4}$ ounce flux blue; 1 ounce manganese; 1 ounce red lead; 1 ounce flint;—for the enamelling kiln. *A good mulberry colour for grounds and printing.*

WEDGWOOD'S WHITE PEARL BODY.

Brown clay, 150; Taylor's blue clay, 200; cornish clay, 350; stone, 76.

Make of this clay 42 half strikes of slip, to which add

13 half strikes and 1 peck of flint of the same consistency as the above mixture; add 4 oz. of blue, sifted through No. 16 lawn; the calx to be ground in a dish three or four hours; then add about 1 pint of slip to the above calx, after which grind one hour at least, that it may be thoroughly mixed.

N.B. When the above body is for blue printing, put in half a strike of chalk and cracking clay, and not brown.

Mould body.—Of pitchers, 100; flint, 100; ball clay, 145.

COLOURS UNDER GLAZE.

Orange.—Red lead, 3 lbs.; crocus martus; 1 lb.; crude antimony, 2 lbs.

WEDGWOOD'S BEAUTIFUL JASPER.

Cauk stone, 168; blue clay, 91; cornish clay, 60; flint, 40; raw plaster, 8.

N.B. It is better to make this ball clay before mixed, 1 grain of calx to 1 lb. of clay. To prevent Jasper from sticking take 8 or 12 of alum to 1 of charcoal; the alum must be well roasted before mixed with the charcoal: then mix it well, and put it in a vessel at the top of a biscuit oven: when calcined pound it, put it in a vessel, and pour hot water upon it repeatedly, to take out the salt, then grind it in a stone dish, and use it.

Metallic Lustre.

Spirits of salts, 2 ounces; nitre, 1 ounce; gold, 6 pennyweights 1 grain; block tin, 18 grains; balsam of sulphur, 3 ounces.

Observe.—When the gold has done working, put in the block tin. The balsam of sulphur must be mixed with the spirits of turpentine, until it is a little thicker than milk, then pour in your gold solution, and stir it well together.

COLOURS MADE FOR UNDER GLAZE.

Yellow.

Red lead, 4 lbs.; antimony, 1 lb.; tin ash, 4 lbs.; flint, 1 lb.

Green for printing under glaze.

Glass, 1 lb.; flint, $\frac{1}{2}$ lb.; litharge, $3\frac{1}{2}$ oz.; best blue

calx, 3½ oz. To be run down in an oven. 1 lb. of the above to 1 lb. best yellow.

Brown under glaze.

Glass of antimony, 8 oz.; litharge, 16 oz.; manganese, 3 oz.; blue calx, 4 drms.

Yellow under glaze.

Crude antimony, 4 lbs.; litharge, 4 lbs.; tin ashes, 2 lbs.

Orange under glaze.

Litharge, 6 lbs.; antimony, 4 lbs.; copperas, 1 lb. These to be calcined at the top of glost oven.

Black glaze.

Red lead, 24 lbs.; raddle, 4 lbs.; manganese, 4 lbs.; flint, 2 lbs.; blue, 2 oz.

Green glaze.

Copper, 8 lbs.; flint, 8 lbs —Calcined and ground; glass, 3 lbs.; flint, 1 lb.; lead, 6 lbs.

The above to be ground all together, and one quart added to six quarts of white glaze.

Yellow glaze.

Dried flint, 5 lbs.; Cornwall stone, 15 lbs.; litharge, 50 lbs.; yellow, 4 lbs.

No. 1, *for Blue Printing.*

Blue calx, 4 lbs.; stone, 4 lbs.; flint, 1 lb.; glass, 1 lb.; borax, 1 lb.—These two on china.

No. 2, *for Blue Printing.*

Blue calx, 5; cauk stone, 5⅔ lbs.; stone, 1½ lbs.; flint, 1 lb. These as good as can be used.

WEDGWOOD'S No. 1, EGYPTIAN BLACK.

Ball clay, low flinted, 300; calcined ochre, 24; manganese, 7.

Brown Body.

Bradwell clay, 40 lbs.; clay slip, 1 pint; ochre, 25 lbs.; nickle, 1½ lbs.

Wash for the inside.—Cornwall stone, 10 lbs.; clay, 8 lbs.; clay slip, 5 pints; printing blue, ½ oz.

Glaze for it.—White lead, 40 lbs.; flint, 12 lbs.

MORTER BODIES.

No. 1.—A good white.—Blue clay, 6 lbs.; Cornwall stone, 3 lbs.; china clay, 1 lb.; flint, 1 lb.

No. 2.—Blue clay, 24 lbs.; Cornwall stone, 1 lb.; flint, ½ lb. Not quite so white as No. 1.

No. 3.—Blue clay, 6 lbs.; cornish stone, 2 lbs.; china clay, 2 lbs.; flint, 1½ lbs.—Used at Mason's.

PHILIP EATON'S WHITE BODY FOR BLACK PRINTING.

Soak rough pot.—1 of black, 1 of blue clay, 40 lbs. of stone to 1 ton, 12 parts slip, 24 oz. to pint; 4 cornish clay, 26 oz. to pint.

Ironstone Body.

350 lbs. Cornwall stone, 300 lbs. Cornwall clay, 160 lbs. blue clay, 60 lbs. flint, 14 oz. blue calx.

Fritt for Ironstone body.—90 lbs. Cornwall stone, 20 lbs. salt of soda.

Glaze for Ironstone body.—33 lbs. of the above fritt; 33 lbs. Cornwall stone; 85 lbs. whiting; 80 lbs. white lead.

CAREY'S BEST BLUE BODY.

40 parts blue clay; 16 flint, 2 stone, 12 china clay.

Fritt for the above.—30 lbs. borax, 36 lbs. flint, 15 lbs. Paris white, 40 lbs. stone, 2 oz. blue calx.

Very good.

Glaze.—Add to the above 32 lbs. stone, 32 lbs. lead, 4 lbs. borax.

Enamel Blue.

64 oz. flint glass, 20 oz. red lead, 4 oz. pearl ash, 8 oz. white enamel, 4 oz. common salt, 8 oz. best blue calx. To be run down in the glost oven, then ground, and add 4 oz. of red lead; then grind it, when it will be fit for use.

White Enamel.

5 oz. red lead, 16 oz. flint glass, 2 oz. nitre, 1 oz. arsenic. Run down together in the glost oven.

Base of Enamel Green.

16 oz. red lead, 6 oz. flint, 1 oz. borax, 2½ oz. copper. Run down together in the bottom of glost oven.

Yellow Green.

7 oz. base, 1 oz. biscuit yellow, 5 oz. red flux, No. 8.

Blue Green.

4½ oz. base green, 2 oz. white enamel, 5 oz. flux, No. 2.

Yellow.

6 oz. base, 8 oz. red flux, 1 oz. biscuit yellow.

Green flux to be run down in the top of the fore bung in the glost oven. Flint the crusibles well.

Flux for No. 2 Blue Green.—16 oz. glass, 4 red lead, 4 borax.

Flux for Yellow.—3 oz. red lead, 1 oz. flint.

Flux for Red.—To be run down over common fire. 6 ounces red lead, 4 borax, 2 flint glass, No. 8.

Enamel Red, No. 1.

3 of litharge, 2 of antimony, 1 of iron scales.

Another Red, No. 2.

1 of litharge, 1 of antimony, ½ of iron scales.

Red and Yellow to be spread on plates in glost oven.

Yellow.

8 of litharge, 6 of flint, 3 of antimony, 2 of ochre, 4 of glass.

Another Yellow.

3 of litharge, 4 of powdered brick, 3 of antimony; to be calcined on glost oven, and spread on glost plates.

Brown Enamel.

20 of litharge, 10 of antimony, 1 of calx blue.

Black under glaze.

1 of red colour, 1 of manganese, 1 of calx blue; to be calcined on glost oven, and spread on plates.

Enamel blue.

3 of flint glass, 10 of red lead, 2 of nitre, 2 of potass, 1 china clay, 2½ calx blue.

Enamel Black.

12 ounces borax, raw; 8 ounces umber, calcined; 3 ounces enamel blue. Calcine the above on top of glost oven.

MASON'S NEWLY-IMPROVED STONE BODY.

12½ cwt. china clay, 12½ flint, 10 stone, 2½ blue clay. Stained with 2 lbs. 7 oz. of zaffre.

Glaze for the above.—50 lbs. borax, 15 flint, 25 stone, 30 spar; to be run down in glost oven. When ground fine ready for use.

Shining black glaze.

100 lbs. lead, 18 flint, 40 manganese.

Green body.

30 quarts blue clay slip, 40 ounces blue stone vitriol, 1 ounce fluxed blue liquid.

Glaze for green body.

48 lbs. white lead, 25 stone, 10 flint, 5 ground glass.

Flux for blue.

16 lbs. flint, 2 lead, $2\frac{1}{2}$ borax, 1 pearl ash.

China body.

350 lbs. bone, 200 Cornwall stone, 175 Cornwall clay, 30 blue clay, $4\frac{1}{2}$ oz. blue calx.

Fritt for the above.

50 lbs. Cornwall stone, 20 salt of soda.

Glaze for the above.

50 of the above fritt to 20 of lead.

Blue Dip and Figure Clay for China Jugs.

8 lbs. china clay shavings, $1\frac{1}{2}$ oz. cobalt blue.

A good Green glaze for gilding upon.

1 quart stone glaze, 3 ounces Fox's under glaze green. A pretty light green colour is the same as 2 lbs. green, 10 quarts stone glaze.

A very good dark Orange glaze.

1 quart stone glaze to 4 oz. orange under glaze. The charge is weighed in wet state.

Pin body.

Very good.—6 of stone, 2 of blue clay, 2 of plaster, 1 of flint.

WEDGWOOD'S STONE BODY.

Too hard to fire with earthenware.—3 lbs. Cornwall stone, 6 lbs. china clay, 1 lb. blue clay, $\frac{1}{2}$ lb. flint.

Glaze for the above.

130 lbs. white lead, 50 stone, 25 flint, 25 glass. Take 15 quarts of this, each quart 4 lbs.; put this in a tub, and add 5 lbs. cobalt blue; let them be well blunged together and sifted through a fine lawn; after this let it stand two or three days, and take off all the water you can, so that it may be dipped thick. Let it be placed in good saggers, and well wadded, so that no air can get in; place them in the arches and ring, as it requires a good hard fire.

BLUE JASPER, No. 1.

40 lbs. blue clay, 80 cauk stone, 40 Cornwall stone, 1 blue calx.

BLUE JASPER, No. 2.

40 lbs. blue clay, 120 cauk stone, 20 bone, $1\frac{1}{8}$ blue calx.

Edging green under glaze.

9 oz. copper calx, $3\frac{1}{2}$ lbs. white lead, 27 oz. dried flint, 9 oz. blue clay, $\frac{1}{4}$ oz. blue calx.

Edging green upon glaze.

3 lbs. white lead, $2\frac{1}{2}$ copper, $1\frac{1}{2}$ flint glass, 2 dried flint, 1 ounce liquid blue, fluxed 1 and 1; 7 quarts and 1 pint painted glaze.

Cane body.

6 teacupful of marl slip, 3 of common slip. . . . . .

Another Cane body.—400 black marl, 100 white shavings, 60 Cornwall stone.

China glaze for Printing.

40 lbs. glass, 2 lead, 3 or $3\frac{1}{3}$ blue calx.

16 lbs. glass, 5 lead, 1 arsenic, $2\frac{1}{2}$ nitre.—White Fritt. Take 11 of white fritt, put the whole of the blue fritt, and grind them together; then take of the mixed fritt 8 lbs., 5 flint, 12 Cornwall stone, 23 lead, 62 common salt.

MINTON'S GLAZE, NOW IN USE.

48 lbs. glass, 50 flint, 16 borax, 16 red lead, 24 soda.—Fritt. Add 2 lbs. borax to grind.

68 lbs. glass, 68 of the above fritt; when dry, 84 lbs. stone, 24 flint, 138 red lead; 380 lbs. the whole charge for the mill. This recipe say 21 oz. blue.

VIOLET BLUE.

4 tartar, 2 red lead, 5 flint, $\frac{1}{2}$ magnesia.

PURPLE BROWN.

15 red lead, 18 flint, 1 magnesia, 15 flint glass.

BLUE.

26 oz. zaffre, 18 pearl ashes. A teaspoonful of charcoal.

SMALTS BLUE.

1 lb. flint glass, 2 oz. red lead, 2 dried flint, 1 nitre, 1½ calx. Put on the top of glost oven.

RED UNDER GLAZE.

3 lbs. calcined copperas, 1 flint, 1 red lead.

YELLOW UNDER GLAZE.

4 lbs. tin ashes, 1 litharge, 1 antimony. Put on a biscuit dish, bottom of glost oven.

GREEN UNDER GLAZE.

5 oz. of the above yellow, ½ oz. copper calx.

COLOUR FOR BLUE PRINTING.

23 oz. dried flint, 3 of best flint glass, 2 of cobalt, 1½ lbs. blue calx.

Another.—18 oz. dried flint, 2 of flint glass, 2 of cobalt, 1½ lbs. blue calx.

Another,—1½ lbs. dried flint, 1 of flint glass, 2½ of blue calx.

Green under glaze.

¾ oz. of blue that is fluxed, ½ lb. copper calx. All to be calcined at the bottom of the fore bung in glost oven.

Pea green under glaze.

1 oz. calcined brass, 3 oz. common glaze, ½ drm. calcined cobalt.

Yellow under glaze.

2 litharge to 2 antimony, 1 tin ashes.

Flux for blue.

32 lbs. flint, 5 of borax, 4 of lead, 2 of tin, 2 of pearl ashes. Put all together in a sagger, in the hotest place in the biscuit oven.

MASON'S CHINA BODY.

280 lbs. bone, 200 of china clay, 160 of stone, 30 of flint.

Fritt for the above.

58 lbs. stone, 22 of flint, 22 of glass, 35 of borax — 104 lbs. when calcined.

Glaze.

76 lbs. white lead, 1 teacupful of blue.

Preparations of Gold.

$\frac{1}{4}$ oz. gold, 45 grains quicksilver, 5 flux.

Another.—3 pennyweights of gold, 51 grains of quicksilver, 3 grains of flux.

Another.—1 pennyweight of gold, 17 grains of quicksilver, 1 flux.

Another.—Good.—3 pennyweights of quicksilver, 3 pennyweights of gold, 3 grains of white lead.

ZAFFRE BLUE.

To one cask of zaffre add 72 lbs. potass, 16 lbs. charcoal; then put the cakes of regulus that you will have at the bottoms of the crusibles into a ladle, and melt of bismouth, and clean the cakes, then pound them. To 1 lb. of regulus, 2 oz. of ashes, 1 oz. Windsor glass, run down in small cups, then chip off the iron that you will find at the top of the regulus.

First calxing.—1$\frac{1}{2}$ lbs. regulus, 1 oz. boiled plaster.

Second calxing.—1 lb. regulus, 1 oz. boiled plaster.

2 lbs. zaffre, 1$\frac{1}{4}$ lb. pearl ash, $\frac{1}{4}$ lb. ground charcoal, 2 oz. flour of brimstone. Mix them well together, and put them into a crusible on the top of the glost oven.

Flux for Blue.

16 lbs. flint, 2 of lead, 2$\frac{1}{2}$ of borax, 1 of pearl ash.

Brown body.

5 of red clay, 2 of china clay, 1 of blue clay.

For Pink under glaze.

40 lbs. oxide of tin, 20 of whiting, 3 of flint glass, 1 of oxide of crome. Grind altogether first, then calcine them in the biscuit oven.

White glaze.

50 lbs. Cornwall stone, 10 of flint glass, 5 of dried flint, 5 of nitre, 1 of common salt, 5 of borax; to be run down in glost oven.

2 fritt, 1 white lead.

Black under glaze.

1 of orange red, 1 of manganese, 1 of blue calx; spread on plates on the glost oven.

Blue.

36 oz. zaffre, 18 oz. pearl ashes, teacupful of ash coal.

Drab body.

$\frac{1}{4}$ oz. calx blue, sifted; $\frac{1}{4}$ oz. manganese, 1 quart thick white slip, 1 pint black marl slip.

Slate colour body.

300 of ball clay, low flinted; 40 quarts ochre slip, 7 manganese.

Flux for Blue Edging.

4 lbs. flint glass, 1 of blue calx, 2 oz. nitre, 2 oz. borax.

Brown under glaze.

1 lb. burnt ochre, 1 of manganese, 1 of blue.

Orange base for Clay.

3 lbs. litharge, 2 of crude antimony, 1 of crocus martus; pounded together, and spread on flinted dishes on the top of biscuit oven.

Flux for Rose colour.

16 oz. glass, 5 oz. red lead.

Flux for Blue Green.

16 oz. glass, 4 of red lead, 4 of borax.

A fritt for a China body.

100 lbs. Lin sand, 10 of soda; melted in water, and poured into the Lin sand, and calcined in the biscuit oven.

China body.

60 lbs. of the above fritt, 15 lbs. of glass; 44 gallons of bone, 32 ounces to pint; 14 of stone, 32 oz. to pint; 44 of china clay, 26 oz. to pint; one quarter of pint of liquid blue.

Fritt for China glaze, to be calcined in glost oven.

Cornwall stone, 80 lbs.; borax, 60; Paris white, 50; felspar, 40; nitre, 10; dry flint, 10.

China glaze.

100 lbs. of the above fritt, 32 of lead, 45 of stone; 1 lb. of dry stain—it will do without.

Red Sponge Dip.

4 quarts red slip, 2 quarts white slip, 1 lb. steel filings, 1 lb. lead ore.

Purple Dip.

40 quarts of blue clay slip, 1 oz. calx blue, well ground; 2 oz. manganese.

Blue Dip.

50 quarts blue clay slip, 1 oz. calx blue.

Green Dip.

5 quarts cane slip, 5 oz. ground zaffre, 1 oz. copper scales.

White Dip.

6 quarts blue clay slip, 1 lb. steel filings, 1 lb. lead ore.

Green Dip.

1 quart blue clay slip, $1\frac{1}{2}$ oz. ground nickle.

Olive Green Dip.

12 quarts cane slip, $\frac{1}{2}$ oz. zaffre, well ground; 2 oz. copper scales.

Olive Dip.

1 quart black marl slip, 2 quarts blue clay slip, 2 oz. zaffre.

Green Drab Body.

4 lbs. stone, 2 of china clay, 2 of blue clay, 4 oz. ground nickle.

Blue Dip.

Very good.—4 lbs. Cornwall stone, 1 lb. Cornwall clay, 3 pints bone slip, 3 pints blue clay slip, 10 oz. cobalt blue. Fluxed liquid.

A light Brown for under glaze.

2 lbs. litharge, 1 of antimony, 1 of manganese, 1 oz. zaffre. For the bottom of glost oven.

Dark Brown for under glaze.

10 lbs. litharge, 6 of antimony, 1 of manganese, 1 of zaffre. To be calcined in biscuit oven.

Blue glaze.

1 quart stone glaze, 6 oz. zaffre liquid.

Slate coloured glaze.

$\frac{1}{2}$ oz. ground nickle (good weight), $\frac{1}{2}$ pint stone glaze.

A Drab glaze.

6 lbs. red lead, 1 of raddle, $\frac{1}{4}$ lb. flint, $\frac{1}{4}$ oz. blue.

Purple China body.

3 lbs. bone, 2 of stone, $2\frac{1}{2}$ of brown clay, 1 of china clay, 21 grains blue calx.

Fritt of the above.

40 lbs. Cornwall stone, 25 of flint, 10 of nitre, 20 of

borax, 10 of white lead, 40 of glass. To be run down in glost oven.

Glaze for it.

40 lbs. white lead, 1 of common salt. Grind the whole together.

DAVENPORT'S GLAZE TO CHINA BODY.

56 lbs. stone, 16 of borax, 15 of flint, 60 of lead, 18 of glass.

SPODE'S PRINTED BODY.

4 quarts blue clay slip, 1 of china clay slip, 1 of slop flint.

Glaze to the above.

30 lbs. white lead, 12 of Cornwall stone, 5 of dried flint.

DAVENPORT'S CHINA BODY.

12 lbs. bone, 8 lbs. 13 oz. stone, 5 lbs. 9½ oz. china clay, 2 lbs. 7 oz. blue clay, 1 lb. 9½ oz. flint, ¼ oz. blue calx.

China body.

220 lbs. stone, 60 lbs. china clay, 16 quarts slop flint, (each quart to weigh 4 lbs.); 80 quarts bone slip, (each quart to weigh 4 lbs.); 1 oz. calx blue.

Glaze for it.

26 lbs. borax, 56 of stone, 20 of glass, 70 of lead.

Enamel Yellow.

6 lbs. white lead, ½ lb. flint, ½ lb. tin ashes. To be mixed well together, run down in an enamelling heat, and poured into warm water.

White Enamel.

16 lbs. flint glass, ½ lb. arsenic, ½ lb. nitre, 5 lbs. litharge. To be calcined in biscuit oven, in a sagger well flinted and wadded.

MASON'S DRY BODY.

500 lbs. Cornwall stone, 400 of china clay, 440 of flint, 310 of blue clay, 1½ oz. liquid blue, as it comes from the mill.

Figure Clay for the above.

8 lbs. of the same shavings, 2 oz. cobalt blue.

Glaze for the above body.

135 lbs. white lead, 50 of stone, 25 of flint, 25 of

glass, 3½ oz. liquid zaffre, thick as it comes from the mill.

WEDGWOOD'S WHITE BODY.

1 lb. blue clay, 3½ of Cornwall stone, 4 ounces china clay, 4 of flint.

Fritt for the above.

5 lbs. borax, 1½ of flint, 2½ of stone, 3 of spar.

Glaze to the above.

50 lbs. borax, 15 of flint, 25 of stone, 30 of spar.

Green glaze.

19 lbs. copper scales, 18 of flint; to be calcined and ground together: when sent to the mill, add 6 lbs. and 3 quarters glass, 2 lbs. and 1 quarter flint, 12 lbs. white lead; 1 ounce of this to six ounces of white glaze.

Dip for Figures.

10 lbs. china body, 3 ounces calx blue.

YATES'S BLACK BODY.

10 lbs. blue clay, 8 of ochre, 3 of manganese. Takes a good fire.

White Opaque body.

5 lbs. blue clay, 5 of stone, 3 of flint.

Setter Clay.

2 lbs. ball clay, 2 of sagger clay, 2 of fine gnog, 1 of sand.

Green ground.

1 ounce biscuit yellow, ½ ounce zaffre blue.

Orange glaze.

1 quart stone glaze, 4 ounces orange under glaze; weighed in the wet state.

Green for gilding upon glaze.

2 lbs. green colour, 10 quarts stone glaze.

White stone body.

18 lbs. stone, 8 of blue clay, 1 of glass.

Another.—9 lbs. stone, 1 of common clay, 3 of blue clay, 12 of flint, ½ of glass.

Wash for Glost Saggers.

5 quarts of lime slip, 1 quart of ball clay slip.

WEDGWOOD'S COMMON GLAZE.

20 lbs. Cornwall stone, 40 of flint, 120 of lead.

Rockingham glaze.

15 lbs. dry flint, 15 of manganese, 36 quarts stone glaze.

DREWRY'S CHINA BODY.

300 lbs. bone, 200 of Cornwall clay, 150 of stone, 4 ounces blue calx.

Fritt for the above.

60 lbs. stone, 30 of flint, 30 of borax, 20 of glass, $\frac{1}{4}$ ounce blue calx. To be calcined in biscuit oven.

Glaze for the above.

The whole of the above fritt, and 90 lbs. of lead.

Vitrified Cane body for White Figures.

1 quart of Cornwall stone, 2 quarts of marl slip, $\frac{1}{2}$ pint of glaze.

Cream colour glaze.

68 lbs. dry flint, 30 of dry stone, 228 of Bristol lead.

NIXON'S CHINA.

90 lbs. dry flint, 60 of china clay, 30 of blue clay, 30 of black clay.

Fritt for the above.

40 lbs. stone, 24 of borax, 10 of flint. To be calcined in the bottom of glost oven.

Glaze for the above.

60 lbs. of the above fritt, ground and dry; 40 lbs. lead, 1 ounce blue calx. To be dipped thick.

FLOWS FOR BLUE.

No. 1.—12 of Linn, 1 of sal ammoniac, 2 of red lead.

No. 2.—4 of Linn, 1 of common salt, 1 of soda.

No. 3.—21 of whiting, 4 of lead, 4 of salt, $2\frac{1}{2}$ of nitre.

For gilding, in the following proportions:—

All small ware, such as egg-cups and ladles, $\frac{1}{2}$ ounce; small muffins, 5 and 6 inch, $\frac{3}{4}$ ounce; 7 and twifflers, 1 ounce; plates, and 9 and 10-inch dishes, $1\frac{1}{2}$ ounce; 20-inch dishes, ewers, and bowls, $4\frac{1}{2}$ ounces; leg-pans, 5 ounces. For regular Flow, a little stronger.

EXTRACTED FROM BAILIFF JAMES ———'S RECIPE BOOK.

Stone Body.

480 parts Cornwall stone, 250 of b. clay, 240 common clay, 10 of glass, 1 of calx.

1 oz. zaffre to every 100 lbs.

Glaze for Cane.

40 parts stone, 20 of flint, 80 of white lead.

Black Glaze.

4 parts lead, 1 of flint, 1 of shavings.

Common Body.

30 parts b. clay, 11 of flint, 13 of common clay, 5½ of stone.

STEPHENSON'S COMMON BODY.

21½ b. clay, 15 of common clay, 12½ of flint, 1½ of stone.

Pink.

100 lbs. oxide of tin, 50 lbs. chloride of lime, 5 lbs. oxide of chrome.

10 of the above, 1 of flint.

Burnish Gold.

Good.—1 pennyweight of gold, 20 grains of quicksilver, 2 grains of white lead, 4 leaves of leaf silver.—It will do with or without leaf silver.

Yellow under Glaze.

8 parts tin ash, 1 of litharge, 1 of antimony.

Green.

Good.—12 of yellow, 1 of blue calx, 2 of flint, 4 of glass.—To be fired in the top of glost oven.

Brown.

1 lb. manganese, 2 of antimony, 2½ of litharge, 1 oz. blue calx.—To be fired in the top of glost oven.

Green under Glaze.

4 lbs. yellow, 1 of blue smalt, ¼ of copper, calcined.

Smalt.

8 parts glass, 1 of blue calx.

Printing Black.

2 parts iron scales, 2 of nickle, 2 of chromate of iron, 2 of blue calx.

Printing Black.

1 part blue calx, 2 of amber, 1 of base green, 9 of flux, (No. 8.)

Green under glaze.

3 parts calcined copper, 6 of glass, 6 of stone.
1 of the above to 3 C. C. glaze.

Edging Green.

1 part calcined copper, 2 of slip, unflinted; 2 of flint, 16 of glass.

Dark Black.

1 part iron scales, 1 of nickle, 1 of manganese, 1 of calx.

Blue Black.

1 of iron scales, 1 of nickle, 1 of amber, 1 of calx.

Printing Oil.

1 quart linseed oil, 1 pint rape oil, 2 oz. balsam of capavi, $\frac{1}{2}$ oz. amber oil, $\frac{1}{2}$ oz. white lead, 1 oz. pitch.

Another.

1 quart linseed oil, $\frac{1}{4}$ pint rape oil, $\frac{1}{4}$ pint common tar, 1 oz. balsam of sulphur, 1 oz. balsam of capavi.

Enamel Blue.

No better in use.—1 part nitre, 15 of glass, 5 of red lead, 1 of potash, 1 of white enamel, $1\frac{3}{4}$ of blue calx.

Another.

Good.—14 parts glass, 5 of red lead, 1 of white enamel, 2 of blue calx.

Another.

Good.—10 parts glass, 5 of red lead, 2 of nitre, $\frac{1}{2}$ of white enamel, calcined; $\frac{1}{2}$ of blue calx.

Enamel White.

Good.—8 parts glass, 1 of red lead, $1\frac{1}{2}$ of nitre, 1 of arsenic.

Another.—Good.—16 parts glass, 5 of red lead, 1 of nitre, 1 of arsenic.

Enamel Green.

10 parts glass, 13 of red lead, 5 of borax, 6 of flint, 2 of copper, 4 of unfluxed yellow.

For Blue Green leave out the yellow, and add 1 of white enamel.

Enamel Yellow Green.

10 of glass, 18 of red lead, 6½ of unfluxed yellow, 6 of flint, 3 of copper, calcined.

Enamel Chrome Green.

32 parts red lead, 11 of flint, 2 of borax, ½ of copper, calcined.

Enamel Blue Green.

In present use.—6 parts flint, 16 of red lead, 3 of borax, 1 of copper, 6 of white enamel.

Another.

10 parts borax, 12 of flint, 12 of white enamel, 30 of red lead, 4 of copper, calcined.

Another.

10 parts glass, 18 of red lead, 5 of borax, 6 of flint, 2 of copper.

3 of the above to 1 of white enamel.

Fine Green.

1 part verdites, 1 of glass, 3½ of flint, 7½ of red lead.

Heath Green.

1 part chrome green, 2 of tin ash.

Enamel Yellow.

Good.—1 part antimony, 1 of flint, 4 of tin ash, 4 of white lead.—To be calcined in glost oven.

To 3 of the above add 4 parts white lead, ½ of Naples yellow.—Calcine them; mix 1 of the above.

Purple Enamel.

2 parts rose colour, 1 of blue enamel, ground.

Cornelian Red.

2 parts flux, 1 of chromate of iron.

Flux.

3 parts red lead, 2 of borax, 1 of flint.

Enamel Red.

1 part copper, calcined; 2 of flux.

Flux.

3 parts borax, 4 of red lead, 2 of flint.

Cornelian Red.

1 part chromate of iron, $3\frac{1}{2}$ of flux.

Flux.

3 parts red lead, 1 of glass, 1 of flint.

No other flux will do for this. The flux must be highly calcined, until it forms a dark glass.

Red Brown.

1 of copper, calcined; $2\frac{1}{2}$ of flux.

Flux.

28 parts red lead, 14 of borax, 8 of flint.

Rose Colour.

1 grain of gold, dissolved in acqua regc; 4 grains of block tin, dissolved in acqua regc; pour each separately into a basin of cold water, then drop in the tin when dissolved, and stir with a feather; then let it stand six hours until precipitated; then wash it in hot water; after which add the following:—3 parts borax, 1 of flint, 1 of calx.

Rose Flux.

14 parts glass, 5 of red lead.

Chrome Yellow.

2 parts sugar of lead, 1 chromate of potass.

Flux for Printing Blue.

15 parts flint, 10 of b. clay, $12\frac{1}{2}$ of stone, $7\frac{1}{2}$ of lead. To be calcined in glost oven.

Another.

Good.—18 parts flint, 24 of glass.—Calcined.

Blue for Broseley.

2 lbs. best calx, $11\frac{1}{2}$ of flux.

Another.—10 lbs. calx, 2 of flux.

Enamel Fluxes.

No.	1	2	3	4	5	6	7	8	9
White Lead	5	..	..	..	.....	..	..	..	..
Glass	2	2	6	1	16 or 14	8	..	..	..
Borax	1	1	3	..	.....	2	4	4	..
Red Lead	..	1	8	3	5	2	6	3	3
Flint	..	..	3	1	g. oven.	..	2	1	1

RECIPE BOOK OF BAILIFF JOHN ———.

MASON'S CHINA BODY.

16 parts bone, 9 of stone, 14 of common clay, 4½ of flint.

YATES'S CHINA.

16 parts bone, 14 of common clay, 4½ of flint, 1 drm. of calx.

Drab body.

24 parts Argillaceous marl, 48 of stone, 24 of blue clay, 10 of bone, 1 of nickle, cal.

China body.

440 parts bone,—8½; 260 of common clay,—4; 260 of stone,—4; 2 of calx.

Glaze.

40	parts of borax,			*Fritt*	
40	"	sand fritt,	36	parts of Lint sand,	
32	"	glaze spar,	15	"	pearl ash,
24	"	stone,	3	"	flint.
16	"	whiting.			

45 parts of the above,—12; 15 of stone,—1; 15 of white lead,—2.

Ironstone body.

200 parts of Cornish stone, 150 of Cornish clay, 200 blue or brown clay, 100 of flint, 1 of calx.

Ironstone body.

175 parts Cornish stone, 150 of Cornish clay, 90 of blue or brown clay, 35 of flint, 5 of fritt, (see Fritt No. 30,) ½ of calx.

Superior Painted body.

3 parts blue clay, 1 of black or brown, 2 of Cornish clay, 1¼ of flint, ¼ of Cornish stone.

Common Printed body.

2 parts blue clay, 2 of brown or black, 1 of Cornish clay, $1\frac{1}{4}$ of flint.

Cream-coloured body.

$1\frac{1}{2}$ parts blue clay, $1\frac{1}{2}$ of brown clay, 1 of black clay, 1 of Cornish clay, $\frac{1}{4}$ of Cornish stone.

Lilac Porcelain body.

200 parts bone, 115 of Cornish clay, 25 of blue clay, 20 of flint, 15 of cauk stone, 10 of Cornish stone, $1\frac{1}{4}$ of calx.

This body requires a fire the same as the Porcelain body.

Brown body.

20 parts red or brown clay, 8 of Cornish clay, 4 of blue clay, 2 of flint.

Fawn or Drab body.

40 parts marl, 4 of Cornish clay, 1 of flint.

Calcedonia body.

32 parts yellow clay, 10 of Cornish clay, 4 of flint.

Brown body.

50 parts red clay, $7\frac{1}{2}$ of common clay, 1 of manganese, 1 of flint.

Jasper body.

10 parts cauk stone, 10 of blue clay, 5 of bone, 2 of flint, $1\frac{1}{4}$ of calx.—This body should be ground.

Superior White body.

50 parts cauk stone, 50 of blue clay, 25 of bone, 10 of flint.

For the purpose of Figures in relievo, this and the foregoing should have the temperature of earthenware.

Stone body.

48 parts Cornish stone, 25 of blue and brown clay, 24 of Cornish clay, 1 of glass, 1 of calx.

This will vitrify at the temperature of earthenware, but must be ringed to be kept straight.

Mortar Clay.

48 parts Cornish stone, 25 of blue and brown clay, 24 of Cornish clay, 1 of glass.

Black Egyptian body.

235 parts blue clay, 225 of calcined ochre, 45 of manganese, 15 of Cornish clay.

The manganese should be free from lime and calcarious earths.

Ring body for China.

150 parts blue clay, 100 of Cornish stone, 100 of bone, 52 of plaster.

Saucer Mould Clay.

10 parts flint, 4 of blue clay, 2 of Cornish clay, 1 of black clay.

Silicious and Argillaceous Clays.

White body.

No. 1.—4 parts blue clay, 2 of Cornish clay, 2 of flint, 1 of Cornish stone.

No. 2.—30 parts white clay, 1 of blue calx.

Ironstone body.

250 parts common clay, 300 of flint, 300 of stone, 240 of blue clay, 6 oz. calx.

WEDGWOOD'S MORTER.

240 parts ball clay, 100 of stone, 80 of common clay.

Porcelain glaze.

Good.—40 parts Cornish stone, 38 of borax, 32½ of flint, 22½ of flint glass, 13 crystal of soda, 5 of oxide of tin, 1 of enamel blue.

Ironstone Glaze.

Good.—36 parts Cornish stone, 30 of borax, 20 of flint, 15 of red lead, 6 of crystal of soda, 5 of oxide of tin, ⅛ of calx.

When the above is calcined, add the following:—

15 parts white lead, 10 of Cornish stone, 10 of flint. Then grind for use.

Fritt for glaze.

No. 32.*

40 parts Cornish stone, 36 of flint glass, 20 of red lead, 20 of flint, 15 of potass, 10 of white lead, 3 of oxide of tin.

* This number and fritt, together with No. 30, are referred to in some of the other recipes.

Fritt for glaze.

36 parts Cornish stone, 30 of red lead, 20 of flint, 20 of borax, 15 of crystal of soda, 5 of oxide of tin.

Alkaline glaze.

30 parts borax, 30 of flint, 18 of Cornish stone, 2 of oxide of tin.

Fritt.

No. 30.

60 parts Cornish stone, 40 of flint, 30 of crystal of soda, 8 of oxide of tin, 4 of borax.

For China and Ironstone in small quantities.

White Opaque glaze.

30 parts tin oxide, 10 of soda, 12 of pearl ash.

To the above.

100 parts lead, 50 of stone.

Rockingham glaze.

4 parts lead, 2 of stone, 1 of manganese.

Green glaze.

106 parts stone, 17 of flint, 7 of soda, 6 of borax, 3 of nitre, 4 of whiting.

To 120 of fritt, 115 parts lead (after ground), 10 of copper.

Drab.

50 lbs. common shavings, 2 lbs. nickle.

Glaze for Cane.

40 lbs. stone, 20 of flint, 80 of white lead.

Black glaze.

4 lbs. white lead, 1 of flint, 1 of shavings.

Glaze for Trials.

3 parts of lead, 1 of flint.

Glaze for Torquoise.

$1\frac{1}{2}$ lbs. flint, 2 oz. zink flowers, $1\frac{1}{4}$ of nitre, $3\frac{1}{4}$ best blue calx.—27 oz. to pint.

Earthenware glaze.

Good.—90 parts white lead, 35 of Cornish stone, 20 of flint glass, 20 of flint, 60 of fritt, (No. 32,) $\frac{1}{4}$ of calx.

White Earthenware glaze.

35 parts Cornish stone, 20 of borax, 10 of crystal of soda, 20 of red lead, $\frac{1}{8}$ of blue calx.

Printing glaze.

90 parts white lead, 45 of Cornish stone, 22 of flint, 20 of flint glass, $\frac{1}{4}$ of calx.

Blue and Green Edge glaze.

72 parts litharge, 36 of Cornish stone, 20 of flint glass, 17 of flint, 1-5th calx.

Cream-coloured glaze.

Good.—85 parts white lead, 40 of Cornish stone, 22 of flint, 16 of flint glass, 8 of fritt, (No. 32.)

Fine Crystal glaze.

105 parts Cornish stone, 90 of borax. 60 of flint, 50 of red lead, 12 of crystal of soda, 10 of oxide of tin, $\frac{1}{4}$ of calx.

Brown Cottage glaze.

60 parts litharge, 32 of flint, 8 of Brown slip.

Drab glaze.

70 parts litharge, 30 of flint, 25 of Cornish stone, 10 of drab slip.

Blue glaze.

50 parts flint, 30 of borax, 22 of red lead, 10 of Cornish stone, 6 of crystal of soda, 6 of oxide of tin, 3 of calx.

Green glaze.

3 parts vitriol, calcined, 1 of flint glass, 1 of flint.

When ground take four quarts of the above to 30 quarts of the following, ground:

35 parts litharge, 20 of flint, 10 of Cornish stone, 10 of fritt, (No. 32.)

Yellow glaze.

95 parts white lead, 35 of flint glass, 20 of flint, 14 of oxide of yellow, 10 of Cornish stone, 16 of fritt, (No. 32.)

HARRISON'S BLACK.

48 lbs. ball clay, 12 of ochre, 2 of manganese.

YATES'S BLACK.

40 lbs. ball clay, 30 of ochre, 10 of manganese, 10 of iron scales.

BAGSTER'S BLACK.

15 lbs. ball clay, 15 of ochre, 2 of manganese.

MOSLEY'S BLACK.

65 lbs. ochre, 43 of manganese, 24½ of iron scales, 170 of ball clay.

Dip for Brown Neck Jugs.

6 parts red clay, 4 of ball clay, 2 of ochre, 1 of nickle.

Drab.

50 quarts white slip, 3 lbs. nickle.

Light.

50 quarts white slip, 2 lbs. nickle.

Drab.

50 quarts slip, 2 lbs. nickle, 4 oz. blue.

MOSLEY'S BLACK, No. 2.

24½ lbs. iron scales, 43 of manganese, 65 of ochre, 170 of blue clay.

BADLEY'S BLACK.

240 lbs. blue clay, 140 of ochre, 24 of manganese.

ANOTHER, GOOD.

26 lbs. blue clay, 150 of ochre, 32 of manganese.

TWAMLER'S BLACK.

90 lbs. ball clay, 40 of ochre, 20 of manganese.

Black Clay.

4 parts Egyptian black clay, 1 of white clay (1), 1 of blue clay (2).

Orange Clay.

4 parts yellow clay, 2 of Cornish clay, 1 of flint, ¼ of Cornish stone.

Green Clay.

12 parts white clay (1), 1 of nickle, ¼ of blue clay (2).

Fawn Porous body.

40 parts Argillaceous clay, 4 of blue clay, 2 of flint.

Naples Yellow Under glaze.

12 parts white lead, 2 of draphonte antimony, 1 of crude sal ammoniac, ½ of alum.

Lining Brown under glaze.

3 parts raw litharge, 2 of manganese, 1 of nitre, 1 of blue calx.

Printing Brown under glaze.

3 parts glass of antimony, 5 of raw litharge, 2 of manganese, ½ of blue calx.

Green for Edging under glaze.

3 parts oxide of copper, 3 of flint glass, 2 of flint, 2 of oxide of tin, 1 of enamel blue.

BLUE PRINTED FLUX.

3 parts flint glass, $2\frac{1}{2}$ of flint, 1 of nitre, 1 of borax.

ANOTHER.

2 parts flint, 1 of Fritt, (No. 32,) $1\frac{1}{2}$ of flint glass.

Printing Blue Flux.

No. 60.

5 parts flint, $1\frac{1}{2}$ of borax, $\frac{1}{2}$ nitre.

Printing and Edging Blue.

2 parts blue calx, 3 of fritt, (No. 32,) $1\frac{1}{2}$ of flint glass, 1 of flint, $\frac{1}{2}$ of white lead.

Strong Printing Blue.

2 parts blue calx, 3 of fritt.

Light Blue, or Broseley.

1 part blue calx, 4 of flux, (No. 60.)

Printing Oil.

1 quart linseed oil, 1 pint rape oil, 1 oz. balsam of capavi, $\frac{1}{2}$ of pitch, $\frac{1}{2}$ of amber oil, $\frac{1}{2}$ of white lead.

Orange under glaze.

6 parts raw litharge, 4 of crude antimony, 2 of crocus mastic, 1 of oxide of tin.

Yellow under glaze.

4 parts raw litharge, 3 of crude antimony, 2 of Fritt (No. 32,) $1\frac{1}{4}$ blue calx.

Green under glaze.

12 parts oxide of yellow, 4 of white enamel, 2 of Fritt, (No. 32,) $\frac{1}{4}$ of blue calx.

Printing Mulberry under glaze.

4 parts manganese, 2 of blue calx, 1 of nickle or nitre, $\frac{1}{2}$ of borax.

PRINTING BROWN UNDER GLAZE.

5 parts raw litharge, 5 of crude antimony, $2\frac{1}{2}$ of manganese, 1 of blue calx.

PRINTING BLACK UNDER GLAZE.

3 parts red lead, $1\frac{1}{4}$ of antimony, $\frac{3}{4}$ of manganese.

After these have been calcined, add the following, and calcine again.

2 parts blue calx, $\frac{1}{4}$ of oxide of tin.

Printing Oil.

1 quart linseed oil, $\frac{1}{4}$ pint rape oil, $\frac{1}{4}$ pint common tar, 1 oz. balsam of capavi, 1 oz. balsam of sulphur.

BLUE STAIN.

5 parts blue calx, 2 of Fritt, (No. 32,) 1 of flint glass, 1 of enamel blue.

Yellow Stain.

3 parts oxide of yellow, 1 of Fritt, (No. 32,) $\frac{1}{4}$ cromate of iron.

Green Stain.

3 parts blue stain, 1 of yellow stain, $\frac{1}{2}$ of enamel blue green stain.

FINIS.

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